
SCOPING STUDY CIRCULAR ECONOMY IN VIETNAM



Ministry of Foreign Affairs



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SUMMARY

Vietnam's per capita GDP growth since 1990 has been among the fastest in the world. A growth which has contributed to impressive progress in alleviating poverty and improving non-income dimensions of welfare. However, this growth has also generated challenges with regard to environmental degradation. The environmental quality of Vietnam's air, land, and water has deteriorated considerably. Moreover, Vietnam is one of the world's most vulnerable countries to climate change, with adaptation challenges accordingly severe, especially in the Mekong Delta. Despite of a relatively high rate of (informal) solid urban waste recycling, the current economy leads to the depletion of precious resources and does not account for negative externalities exerted upon the environment. The circular economy may present a sustainable solution to part of the socio-economic and environmental challenges resulting from the current linear economic model in Vietnam. Dutch businesses could play a valuable role in accelerating the circular economy (CE) in Vietnam. A scoping study was commissioned by RVO and executed at the end of 2017 and the beginning of 2018 to identify potential areas of circular (business) cooperation.

Circular economy as a concept is still quite new to Vietnam. However, the Vietnamese National action plan on Green growth includes many actions that fit perfectly with the transition towards a circular economy and many companies and organisations are familiar with the cleaner production principle of 'Reduce – Reuse – Recycle'. Organisations like the governmental Central Institute of Economic Management (CIEM) and the Vietnam Chamber of Commerce and Industry (VCCI) are interested in the potential of circular economy strategies and VCCI has recently initiated a programme on circular economy, involving VCCI's Vietnam Business Council on Sustainable Development. The Vietnam Cleaner Production Centre (VNCPC) could be a valuable partner in next steps in the country. The same is true for UNIDO, the United Nations Industrial Development Organisation, which is interested to build on its cleaner production work to include circular economy approaches.

The scoping study focuses on five priority sectors: agriculture, logistics, renewable energy, water management and 'smart cities', a concept involving a number of different sectors. The study shows that in each of the five sectors circular approaches can contribute to addressing current socio-economic and environmental challenges, involving a number of sustainable development goals (SDGs). There is still a lot to win in Vietnam where it comes to resource efficiency and basic environmental management. Building capacity on circular approaches will allow government and business to think beyond eco-efficiency and take a value chain approach right from the start, also taking into account reuse, remanufacturing and recycling options. Specific opportunities exist for Dutch technology and know-how in each of the five sectors, with an emphasis on renewable energy and smart cities (e.g. smart lighting, smart logistics, plastic recycling). Circular strategies within water management can offer clear benefits from a social-economic point of view, but the market may not yet be ready to invest in such strategies. Creating best practices through demonstration projects, e.g. by playing into the concept of 'eco-industrial parks' and 'water smart cities', may offer a way forward.

The roadmap enabling Dutch businesses and knowledge institutes to benefit from these opportunities includes a short term focus on creating best practices on circular solutions, building on existing Dutch-Vietnamese partnerships on a sector and (smart) city level, participating in the planned VCCI programme on circular economy and cooperating with the

VNCPC on circular economy capacity building in sectors. The development of a Dutch consortium on circular plastics and renewable energy may offer an interesting follow-up step.

The Dutch government can support Dutch businesses by enhancing the incorporation of a circular economy focus in existing international policy (like the IRBC agreements) and subsidy programs (like FDW, FDOV and DGGF), by supporting potential follow-up missions and the consortium on circular plastics and renewable energy and by investing in government to government capacity building, strengthening circular economy policy development on a national and city level in Vietnam.

The 45 year relationship between the Netherlands and Vietnam provides a perfect opportunity to build a successful cooperation on circular economy between the two countries.



1 INTRODUCTION

1.1 Background

Vietnam's per capita GDP growth since 1990 has been among the fastest in the world. A growth which has contributed to impressive progress in alleviating poverty and improving non-income dimensions of welfare. However, this growth has also generated challenges with regard to environmental degradation. The environmental quality of Vietnam's air, land, and water has deteriorated considerably. Moreover, Vietnam is one of the world's most vulnerable countries to climate change, with adaptation challenges accordingly severe, especially in the Mekong Delta. Despite of a relatively high rate of (informal) solid urban waste recycling, the current economy leads to the depletion of precious resources and does not account for negative externalities exerted upon the environment.

The circular economy may present a sustainable solution to part of the socio-economic and environmental challenges resulting from the current linear economic model in Vietnam. The Netherlands is a Circular Hotspot with a wealth of knowledge and experience on circular economy. Dutch businesses could play a valuable role in accelerating the circular economy (CE) in Vietnam. A scoping study was conducted at the end of 2017 and the beginning of 2018 to identify potential areas of circular (business) cooperation. The study was commissioned by RVO and executed by the following project team:

- CREM (contractor): Expert on CSR in international supply chains and Circular economy.
- Partners for Innovation Partners: Expert on Circular economy and Sustainable innovation.
- Mr. Son Nguyen Ngoc of SYB Consulting and Mrs. Hien Thi Tran, director of Governance for Sustainability & Development (GSD): Experts on local business & business support and on CSR in Vietnam.
- Evofenedex: Experts on international trade and representing 15,000 companies in the Netherlands that export, import and transport goods.

1.2 The scoping study

Objective

The overall objective of the Scoping Study Circular Economy Vietnam is to support the Royal Dutch Embassy in Vietnam and the Dutch private sector to increase bilateral cooperation by linking the socio-economic challenges in Vietnam with Dutch solutions and technologies in the Circular Economy.

The specific objectives of the assignment are to:

- Provide insight in the state of play with regard to the circular economy in Vietnam, its potential contribution to solving the socio-economic challenges Vietnam faces, its growth potential and key conditions to realise this growth potential.
- Identify the key opportunities for Dutch companies in this transition towards a circular economy in Vietnam and the solutions these companies can offer with respect to the socioeconomic challenges identified.
- Define success factors for Dutch companies to do business in Vietnam in this field of work

- Recommend key follow-up steps in the form of a 'Roadmap', laying out how the Dutch government can support Dutch companies in their effort to act on the circular economy opportunities in Vietnam.

Scope

In consultation with the Royal Netherlands Embassy in Vietnam, the scoping study focussed on the following priority sectors of the Embassy:

- Agriculture
- Renewable energy
- Logistics
- Water management
- Smart Cities (a high interest topic in Vietnam, linked to a number of sectors)

These sectors can be linked to the five domains of the Dutch national strategy on the transition towards a circular economy: biomass & food, building & construction, plastics, high-tech manufacturing industry and consumer products (see figure 1).

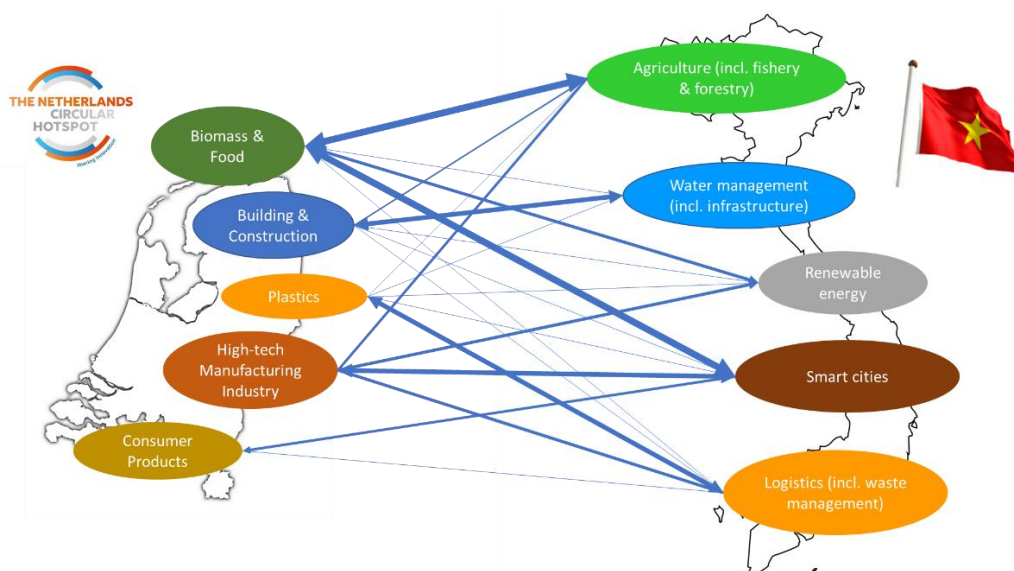


Figure 1 Connecting Dutch knowledge (transition agendas) to Vietnamese markets

Circular solutions/innovations in the Dutch domains may result in opportunities to contribute to the transition towards a circular economy in Vietnam. Overall the linkages are expected to be strongest between the following sectors and domains:

Table 1. Linkages between the Dutch transition domains and priority sectors in the scoping study

	Agriculture	Renewable energy	Logistics	Water management	Smart cities
Biomass & food	X	X			X
Building & construction				X	X
Plastics				X	X
High tech manufacturing industry	X	X	X	X	X
Consumer products					X

These linkages between the Dutch transition domains/agendas will be taken into account in the scoping study when identifying potential opportunities for Dutch companies and organisations.

Definition of a circular economy

There are many definitions of a circular economy. In this scoping study, we use the approach by PBL Netherlands Environmental Assessment Agency:

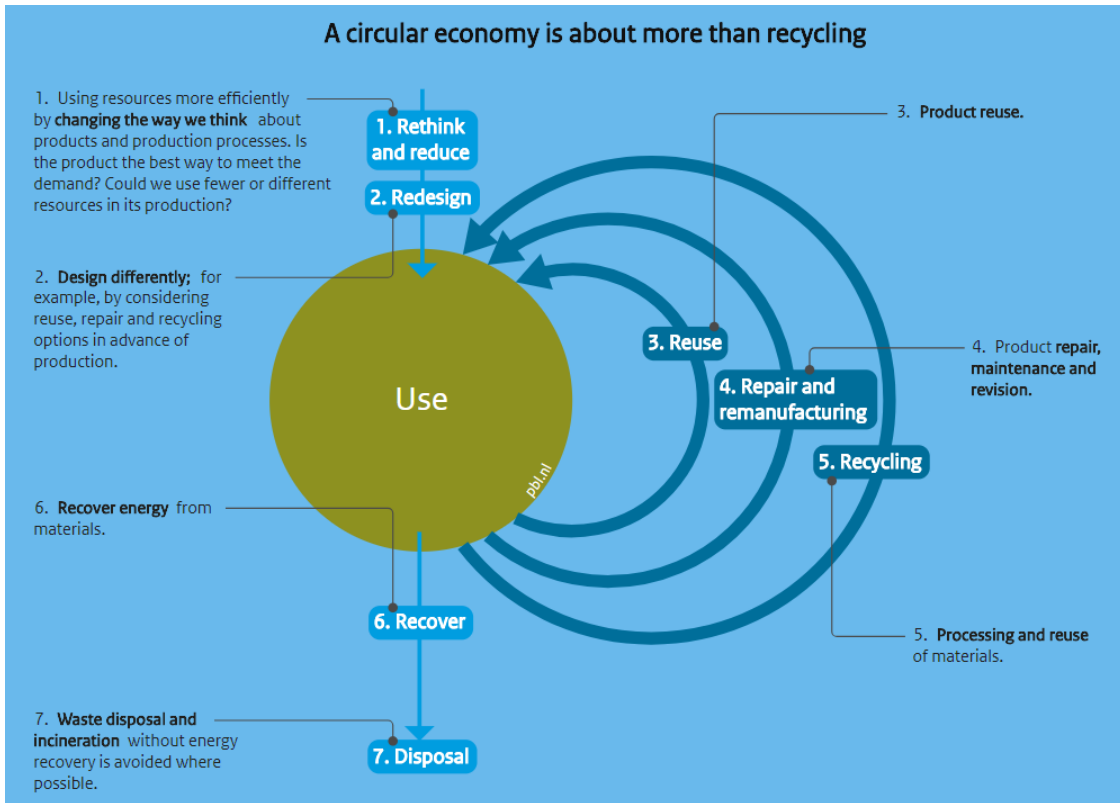


Figure 2. Schematic overview of strategies within a circular economy (PBL Netherlands Environmental Assessment Agency, 2018)

Figure 2 shows that there are different strategies involved, including rethink and reduce, redesign, reuse, repair and remanufacture, recycle, recover and disposal. Some of these strategies focus on closing the (resource) loops, some focus on preventing resources from entering the loops, e.g. by rethinking and redesigning.

Approach

The scoping study consisted of the following steps:

- Desk study on socio-economic and environmental challenges in Vietnam and the state of play on circular economy
- Desk study on Dutch policy instruments available to Dutch businesses that would like to become active on circular economy in Vietnam.
- Scoping mission to Vietnam to discuss the state of play and the interest in circular economy with businesses, government and NGOs (an overview of interviews is included in annex 1).
- A meeting in the Netherlands with Dutch organisations and businesses that are potentially interested in contributing to circular economy initiatives in Vietnam (results are summarised in annex 2).
- A presentation of the preliminary results in Vietnam during the Dutch mission to Hanoi and Ho Chi Minh City in February 2018.

- Development of a road map to benefit from the opportunities on circular economy in Vietnam.
- Draft and final report of the scoping study results.

1.3 Reader

In the following chapters the results of the Scoping Study Circular Economy in Vietnam are presented. In chapter 2, a brief overview of the current status of Circular Economy as a concept in Vietnam is presented. In chapter 3, the results per sector are presented, focusing on the following sectors:

- Agriculture
- Logistics
- Renewable energy
- Water management
- Smart cities

The circular opportunities in each sector are presented in a figure (see figure 3), adapted from the European Union's vision for a circular economy as presented in the SWITCH-Asia publication 'Advancing the circular economy in Asia' (Winter 2016/2017). In this figure, 'raw materials' focuses on the choice and sourcing of raw materials, e.g. the shift from fossil based to biobased raw materials and from virgin material to recycled material. 'Production' refers to ecodesign, like design for re-use, remanufacturing or recycling. 'Consumption' relates to ecoefficiency measures during the consumption phase (e.g. reduction of water leakage from water-infrastructure), but also to product-service systems, where product ownership is replaced by the use of services. Circular strategies with regard to 'waste management' include a waste separation and a shift from landfill to recycling and 'from waste to resources' focuses on strategies like the recovery of nutrients from waste water and the use of agricultural waste in energy production. Of course, the different areas of action are closely linked and circular opportunities can sometimes be placed in more than one area.



Figure 3. Circular economy opportunities (adapted from the EU's vision for a circular economy, SWITCH-Asia Network Facility, 2016)

For each sector the opportunities are briefly explained, including an indication of the social-economic challenges and related SDGs that may drive the interest of government, companies

and/or NGOs in Vietnam in these circular solutions (environmental benefits will not always be sufficient to trigger interest).

In chapter 4, a roadmap is presented which shows what steps are likely to contribute to the success of Dutch businesses in benefiting from the circular opportunities identified in the different sectors in Vietnam.

During the presentation of the scoping study results in February 2018, a factsheet was handed out with the main findings, specified for each of the 5 sectors. This factsheet is included as annex 5 and can be acquired from RVO and the Dutch Embassy in Hanoi.

N.B.: This scoping study is based on a screening of the opportunities through desk research and a scoping mission to Vietnam. The scoping study should be interpreted as a *first step* towards the exploration of circular business opportunities.

2 CIRCULAR ECONOMY IN VIETNAM - GENERAL OVERVIEW

Socio-economic challenges in Vietnam

Vietnam's per capita GDP growth since 1990 has been among the fastest in the world. A growth which has contributed to impressive progress in alleviating poverty and improving non-income dimensions of welfare. However, this growth has also generated challenges with regard to environmental degradation. The environmental quality of Vietnam's air, land, and water has deteriorated considerably. Air pollution has reached alarming levels in cities like Hanoi and Ho Chi Minh City and water pollution and water scarcity is a growing concern, especially in urban areas. Vietnam is among the top five countries causing over half of land-based plastic-waste leakage into the oceans. Despite of a relatively high rate of (informal) solid urban waste recycling, the current informal system of waste collection and recycling in craft villages not only results in hazardous emissions, but also leads to serious health threats. Environmental policy and regulation in Vietnam offer a sound basis for green growth (policies and regulations are in place), but enforcement of legislation is still lacking. With its long coast line, Vietnam is one of the world's most vulnerable countries to climate change. Flood risks and the salinization of agricultural areas, especially in the Mekong Delta, is a growing concern. Climate change adaptation is therefore a key area of interest in Vietnam.

Circular economy – Current status

Circular strategies may present a sustainable solution to some of the socio-economic and environmental challenges in Vietnam initiated by the current linear economic model. Circular economy as a concept is still quite new to Vietnam. However, the National action plan on Green growth includes many actions that fit perfectly with the transition towards a circular economy and many companies and organisations are familiar with the cleaner production principle of 'Reduce – Reuse – Recycle'. Moreover, organisations like the governmental Central Institute of Economic Management (CIEM) and the Vietnam Chamber of Commerce and Industry (VCCI) are interested in the potential of circular economy strategies. VCCI, also involved in the Global Compact and the Vietnam Business Council for Sustainable Development, is considering the establishment of a Centre of Excellence on circular economy. The Vietnam Cleaner Production centre (VNCPC), involved in initiatives like the development of eco-industrial parks and cooperating with Dutch institutions like the TU Delft, is also familiar with circular economy approaches and could be a valuable partner in next steps in the country. UNIDO, the United Nations Industrial Development Organisation, has been active in Vietnam for many years already and is interested to build on its cleaner production work to include circular economy approaches.

Circular economy – Opportunities for Dutch businesses

The scoping study shows that there are opportunities for Dutch businesses to be part of a transition in Vietnam towards a circular economy. VCCI considers Dutch companies and knowledge institutes as valuable partners in the establishment of a Centre of Excellence on circular economy, the Dutch are considered experts on Delta management and the activities of organisations like Brainport Eindhoven show that Dutch organisations can play an important role in hot topics like 'smart cities'. In general, Dutch businesses may benefit from the existing partnerships between the Netherlands and Vietnam on Water and Delta management, Agriculture and Smart (sustainable) cities. Each of these fields of action offer opportunities from

a circular economy point of view, although the chances of success in the short term may differ. Dutch multinational companies like Unilever, Friesland-Campina, Heineken and Philips, in many ways frontrunners on sustainability, could play an important role in creating flagship projects in Vietnam showing what the opportunities of circular business practices are.

Sector specific opportunities

An overview of the specific opportunities for a selection of priority sectors is presented in the next few chapters. For each sector the following information is provided:

- A brief characterisation of the sector
- Environmental and socio-economic challenges related to the sector, including related SDGs
- Policy and regulation potentially relevant to circular business opportunities.
- Characterisation of sector specific circular economy opportunities for Dutch businesses, (structured around 'raw materials', 'production', 'consumption', 'waste management' and 'from waste to resources'), including:
 - Sustainable development Goals (SDGs) which may benefit from these circular strategies
 - A characterisation of the opportunities
 - Potential Dutch partners that may be involved
 - Key initiatives to build on (when relevant)

3 AGRICULTURE

3.1 Characterization of the sector and challenges

3.1.1 Sector characterisation

Decentralized, smallholder agricultural production

Vietnam remains a largely agricultural society with a relatively large percentage of the population living in rural areas (76%). In the rural areas, agricultural labour accounts for 52% of the workforce. In general, agricultural production in Vietnam is decentralized, fragmented with small-household farmers. Currently, agriculture accounts for almost 20% of the national GDP. However, it is expected that in the coming years employment in the primary agricultural sector will decrease due to a diversification of rural livelihoods, causing a declining contribution of 0.5% per annum to the national GDP (World Bank, 2016). Nevertheless, the agro-industry's share is expected to grow and the overall agri-food industry (including food processing) will still account for 35% to 40% of employment in the early 2030s (with more importance in Mekong delta, Central highlands, Southeast and less importance in Red river delta, Central coast and Northern mountainous regions). The vast majority of the Vietnamese agricultural population produces at marginal profits. The income gap between rural and urban areas continues to grow in absolute terms, although the ratio between the two has remained relatively steady (World Bank, 2016). The agricultural workforce has become unstable, more and more people are withdrawn by other sectors and move to the cities. In recent years, there has been an increasing penetration of larger private businesses which have more resources available and show a willingness to invest. This development offers new opportunities for Dutch products and services in the area of circular economy solutions.

Agricultural commodities

In recent years, Vietnam has emerged as one of the world's leading exporters of agri-food commodities and the country is among the top five exporters in the world for coffee, tea, cashew, black pepper, rubber and cassava (World Bank, 2016). In terms of these commodities, the agricultural sector in Vietnam is characterized by geographical specialization with specific crops being produced in certain areas of the country such as:

- Rice in the Mekong River Delta and the Red River Delta;
- Coffee in the Central Highlands;
- Tea in the Northeast and Northwest;
- Black Pepper in the Central Highlands and the South Eastern provinces;
- Cashew in the Central Highlands and the South Eastern provinces;
- Cassava in the North, Central, and Central Highlands;
- Rubber in the Southern provinces.

Over the last decade, Vietnam has significantly improved its rice productivity (increasing its yields between 3.1 and 1.6 percent per annum in the 1990-2013 period) to become the largest exporter of rice in the world (World Bank, 2016).

Livestock: cattle breeding and dairy farms

Vietnam is among the most significant contributors to the expected 10% global growth in all types of meat import demands, and Vietnam is currently ranked 3rd in worldwide pork consumption, remaining only behind the EU and China. There is also a rapidly increasing demand for dairy products, stimulated by both the Vietnamese government and through active communication by

large dairy companies on the health benefits of dairy products, making for a significant increase in animal protein demand. In Vietnam, more than 60 percent of the dairy industry is small household farmers – somewhere between 4 and 70 cows. The rural way of life is under great pressure. Farmers who cannot make a living are deserting the farms and moving to the city. The Department of Livestock Production (under the Ministry of Agriculture and Rural Development) aims to increase its dairy production with 14,1% by 2020 (Dairy reporter, 2018). Vietnam largest dairy producer Vinamilk, representing 80% of total value dairy sales in 2017, is also starting export to the Chinese market.

Aquaculture

In the last two decades, Vietnam has developed into a top exporter of aquaculture products. Vietnam has more than 600,000 hectares of shrimp production and is the global leading producer of black tiger shrimp in the world (300,000 tons per year) (VASEP, 2017). Shrimp farms are mainly concentrated in the Mekong Delta provinces. Vietnam exports its shrimp mostly to Japan, China, USA and the EU. Besides shrimp, Vietnam is the world's largest producer of Pangasius at a production of about 1,200 metric tons annually and almost 6,000 hectares of farming area (VASEP, 2017). Pangasius is mostly exported to the USA, China and the E.U.

Horticulture and floriculture

Horticulture and Floriculture are one of the most promising sectors of the Vietnamese economy. Vietnam, with a population of some 92 million people, is a huge emerging market and the country's exports of Fruits & Vegetables have enjoyed strong growth in the past years, with an average rate of 26.5 per cent a year; from \$439 million in 2009 to an estimated \$ 3 billion in 2017. In recent years, the floricultural sector in Vietnam has grown significantly. Vietnam primarily produces cut-flowers for export to China and Japan, but also the domestic market for cut-flowers is growing. The central highland regions provide the favourable climatic conditions with Da Lat as the epicentre of the floricultural sector accounting for 50% of the country's output.

Demand is changing

Food consumption in Vietnam is projected to increase and diversify. This development is driven by a growing population, expanding middle-class, and urbanization. By the mid-2030s, more than half of Vietnam's population is expected to have joined the middle class (World Bank, 2016). The composition of the diet is expected to change as wealthier consumers shift to income-elastic foods (World Bank, 2016). This will cause an increase in demand for non-grains such as vegetables, fruits and animal proteins (which can be expected to double in the period 2015-2030). Moreover, the increasing urbanization will cause an increase in demand for processed and prepared food products and a decrease in demand for rice.

3.1.2 Challenges

The agricultural sector in Vietnam faces several challenges, potentially affecting a number of Sustainable Development Goals (SDGs):

Overall agricultural productivity in Vietnam is relatively low

Agricultural growth has mostly involved an increase in cropping areas or more intensive use of inputs (fertilizers, chemicals) and natural resources (water, land). The country lags behind regional peers regarding agricultural land, labour, and water productivity and has seen its declines in total factor productivity recently. At the same time, the sector faces domestic competition from other sectors (industry, services, urban development) for the use of



labour, land and water. This negatively influences farmers' income and hinders the potential of economic growth.

Pesticides, herbicides and fertilizer are excessively used

Because of the small-scale production of smallholder farmers, lower yields or a failed harvest can be catastrophic for the farmer. Therefore, inputs are often used excessively. Moreover, the smallholder farmers lack the capital to invest in efficient technologies to reduce the use of these inputs. This negatively influences farmer income, limits the options to reduce poverty in rural areas and increases the pollution of land and water.



Food safety is a concern for Vietnamese consumers

Because the Vietnamese agricultural sector is dominated by smallholder farmers producing on a small scale, technological innovation in the sector has been limited. Moreover, the produce often flows through traditional and informal markets causing that traceability is negligible. These factors have caused unreliable food quality and food safety, negatively impacting consumer health and well-being.



The agricultural sector is disproportionately affected by climate change

The Vietnamese agricultural sector has already been severely impacted by climate change and forecasts show that the sector can expect to continue to be affected by temperature- and sea-level rise, disruption of rainfall patterns, and the intensification of weather extremes. Some of the main impacts of climate change that affects the Vietnamese agricultural sector are droughts and salinization. For example the Mekong delta is losing fertile land annually due to salinization. This reduces production capacity (potentially resulting in malnutrition) and increases the need for climate action.



Water quality and availability causes problems for the agricultural sector

Irrigation has been critical in offsetting water shortages during the dry season and for protecting flood-prone areas during the wet season. Vietnam is subject to both periods of drought and flooding. While irrigation coverage is high, with most amenable areas equipped, the current irrigation systems were designed primarily for rice and several factors impede increases in water productivity. Existing irrigation schemes cannot provide the level of irrigation and drainage services that farmers need to intensify rice production or diversify crops away from rice (World Bank, 2016). Incomplete structures and water losses during operations have many schemes operating at low capacity and there have been problems in managing water quality, especially in relation to the polluting effects of fertilizer and agro-chemical run-off. This influences both the availability of clean water to rural communities and the opportunity for economic growth.



Expansion of the agricultural sector has led to deforestation and soil degradation



Multiple forms of environmental degradation have been associated with the expansion of Vietnamese agriculture. For example, the expansion of shrimp aquaculture in the Mekong Delta has resulted in large-scale destruction of mangroves and has also been a major source of water pollution. Effluent from these ponds (which also contain large amounts of organic wastes) contaminate surrounding freshwater and coastal waters. The expansion of coffee production in the Central Highlands has been an important contributor to deforestation, biodiversity loss, and groundwater depletion. Figure 4 presents the main environmental impacts from the agricultural sector in Vietnam per commodity.

Commodity	Location	Soil degradation	Water and air pollution	Water scarcity and salinization	Deforestation biodiversity	GHG emissions
Rice	MRD	High impact	High impact	High impact	Medium impact	High impact
Coffee	CH	Medium impact	Medium impact	High impact	High impact	High impact
Corn	Northern Mtn	High impact	Low impact	Medium impact	High impact	Medium impact
Cassava	Northern Mtn, CH	High impact	Low impact	Medium impact	High impact	High impact
Pork	RRD & South East	No impact	Medium impact	Low impact	No impact	Medium impact
Shrimp	MRD	Medium impact	High impact	Low impact	High impact	Medium impact
Catfish	MRD	Medium impact	High impact	Low impact	Medium impact	No impact

Figure 4. Main environmental impacts from agricultural production. (World Bank, 2016)

3.1.3 Policy and regulation

The following policies and regulations are important references for business that want to act on circular economy opportunities in the agricultural sector:

- The Master Plan on Agricultural Production development to 2020, vision to 2030.*
 This vision aims to develop modern, sustainable and large-scale agricultural production by applying science and technology to boost quality and productivity thus resulting in high competitiveness in the sector. The private sector is encouraged to enhance their involvement and investment in hi-tech agriculture.
- In November 2017, the Prime Minister ratified a plan to restructure the agriculture sector for 2017-2020.*
 To adhere to international standards, the restructuring programme aims to develop the household livestock and animal husbandry sector by reorganizing the slaughter system to ensure food safety, tightening the monitoring of the use of veterinary drugs and additives in the field, and increasing efficiency in disease control. The government will also help in the development of value production chains and branding strategy. The livestock industry is targeting an annual growth rate of 4.5 to 5 percent. In the seafood sector, the government will prioritize offshore fishing, aquatic breeding, and increase investments to modernize processing and storage facilities to reduce losses. To improve quality and production, the plan aims to increase the use of science and technology in producing high-quality varieties,

developing organic farming, reducing the use of pesticides, and growing crops which are more adaptive to climate change. Source: <http://www.vietnam-briefing.com/news/vietnamese-agriculture.html/>.

3.2 Circular business opportunities for Dutch companies

In the agricultural sector, many opportunities exist for circular practices and business models. The Strategic Partnership Arrangement on Agriculture and Food Security signed in 2014, by Vietnam and The Netherlands, works as an overarching umbrella structure for all existing and new areas of cooperation in agriculture and food security in the broadest sense.

The following opportunities were identified that have the potential to enhance the circularity of the sector and to contribute to the SDGs currently at stake:



Figure 5. Circular business opportunities in the Vietnamese agricultural sector

The opportunities are explained below, including the social-economic challenges/SDGs which may serve as a driver to take action:

Raw materials

Consultancy services on sustainable agriculture, resource mapping and circular strategies



The Netherlands is one of the world's largest exporters of agricultural and food products, thanks to its innovative agrifood technology. The Dutch agrifood sector is a sustainable source of healthy, safe food that is produced with respect for nature and the environment. In Vietnam the awareness and knowledge on technological innovations that can improve agricultural practices is growing. There is a potential for providers of



consultancy services both in terms of mapping of resources for circular business models and in terms of implementing circular strategies. Social economic drivers include the opportunities for economic growth, poverty reduction (increased income security and extra revenues for farmers) and the availability of clean water in rural areas. *Potential Dutch partners:* Consultancies with experience in biomass and biobased materials, such as: SNV, WUR, RHDHV, Circle Economy, etc.

Local production of organic fertilizer



Chemical or synthetic based fertilizer application is widespread. However, Human, animal and environmental health concerns are currently driving growth for organic fertilizer. Currently, the market for organic fertilizer in Vietnam is valued at \$930 million but is expected to grow to \$1,5 billion by 2022¹. The growing market provides business opportunities for players in the organic fertilizer business. Sources for organic fertilizer can be found locally in Vietnam in waste streams of agricultural residues. Social economic drivers include the access to clean water and a reduction of environmental impacts impacting soil fertility. *Potential Dutch partners:* Organic fertilizer producers, such as: Fermofeed, Agro Supplement, ECO Style, etc.

Use of stronger seed varieties to eliminate the excessive use of pesticides, herbicides and fertilizer



With the use of stronger varieties of seeds that are more resistant to diseases, the need for excessive use of chemical inputs will be diminished. The run-off of pesticides, herbicides and fertilizer affects the ecosystems surrounding the agricultural production locations and limiting inputs will benefit both the agricultural entrepreneur as well as the environment. Social economic drivers include the access to clean water and increased income security. *Potential Dutch partners:* Seed producers, such as: Nunhems Seeds, Enza Seeds, Syngenta, RijkZwaan, etc.

Production

Climate Smart Agriculture technologies and services



Most land available for agriculture is already being exploited. However, Vietnam is looking to expand its agricultural sector. Therefore, improving agricultural productivity (land-, labour- and water productivity) through closing yield gaps and the intensification of production processes is key to satisfying this ambition. The importance of improving agricultural productivity is emphasized by the fact that Vietnam is one of the countries impacted most by climate change. Its effects create a need for technologies and farming techniques that put less strain on the environment and ensure sustainable agricultural practices. Climate smart technologies in agriculture provide an opportunity to the Vietnamese agricultural sector to keep up with rising

¹ <https://www.mordorintelligence.com/industry-reports/vietnam-organic-fertilizers-market>

demands while efficiently using resources (producing more with less). Currently, the majority of the agricultural sector in Vietnam is not very technologically advanced and therefore offering these technologies could pose a business opportunity for providers of climate smart agricultural technologies.

The main social economic driver is economic growth.

Potential Dutch partners: CSA Booster Office, Wageningen University & Research, AgriProFocus, SoilCares, Landlife Company, Soil & More, etc.

Smart technologies for small-scale agriculture to improve efficiency and sustainability

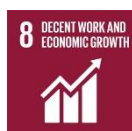


Given that the agricultural sector in Vietnam is dominated by small-scale production, most technological advancement in the agricultural sector is inaccessible for farmers. In order to promote circular- and sustainable practices, there is a need for smart applications that can be used by smallholder farmers to improve the yields and sustainability of their production practices. From discussions with local NGOs it was concluded that technologies like small-scale drip-irrigation (that can be controlled via smartphone) can provide enormous benefits to local farmers, while limiting inputs used for production.

Main social economic drivers are economic growth, reduction of poverty and access to clean water.

Potential Dutch partners: Seed companies, like East-West Seed, and providers of smart irrigation techniques, Hatlenboer-Water, Eijkelkamp Soil & Water, etc.

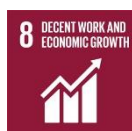
Climate controlled agricultural production with greenhouse technologies



The greenhouse sector in Vietnam is relatively underdeveloped. However, greenhouse technologies provide a number of opportunities with respect to raising agricultural production while limiting inputs. With the agricultural sector in Vietnam increasingly being affected by changing weather conditions, producing in a controlled climate provides clear benefits, especially for high-value products. Currently, Vietnam is South-East Asia's fourth producer of fruits and the domestic vegetable sector is growing simultaneously (Brainport Eindhoven, 2017). Moreover, the production of flowers in Vietnam has taken off in recent years and is experiencing rapid growth. For certain crops, greenhouse technologies can provide a business opportunity for the medium- to large-scale agricultural producer in Vietnam. Main social-economic drivers are economic development and income security for farmers.

Potential Dutch partners: Greenhouse knowledge & technology providers, like Greenhouse technology sector association AVAG (www.avag.nl), Havecon, Certhon, Kees Greve, Ammerlaan Maurice kassenbouw, Cogas Zuid, Meteor Systems, etc.

Cattle breeding technologies and services



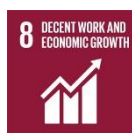
Based on the growing demand for meat and dairy products there are opportunities for Dutch knowledge and sustainable solutions. Medium sized and large turn-key cattle breeding and dairy farms are being build. This also

gives opportunities for sustainable and local Feed production. Friesland Campina is present in Vietnam with the brand Dutch Lady and Lely, provides automatic milking systems for more efficient cattle breeding. Lely also sells used milking robots, with upgrades and technical adjustments, labelled 'Lely Taurus Certified'. In the Feed Industry there are opportunities for local and organic feed production.

The main social-economic driver is economic development.

Potential Dutch partners: Businesses active in cattle breeding and dairy, like Friesland Foods, Lely Industries, De Heus, etc.

Cold chain: mobile cooling and transport facilities and cold storage facilities



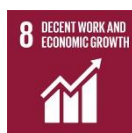
After signing CPTPP, EVFTA Vietnam will focus more on export, especially aquaculture and horticulture products therefore the demand for cold storage will increase. Vietnam already exports a lot of seafood, vegetables, flowers and also imports processed food products and pharmaceuticals. This creates a high demand for climate controlled logistics services. Business opportunities arise for suppliers of sustainable climate controlled logistics. The main social-economic driver for efficient cold storage and transportation is the economic development and prevention of food waste (see also 'Logistics').



Potential Dutch partners: Cold chain technology and service suppliers, such as: Kloosterboer, CoolPack, Flora Holland, etc.

Consumption

Urban farming technology



In recent years, agricultural production in the main cities of Vietnam has sharply risen. Especially vegetable production in urban areas has experienced a steep growth, especially around Hanoi and Ho Chi Minh City. With logistics being problematic, shortening the distance from the producer to the market makes both commercial- and environmental sense. The relative proximity to the market causes reduced need for transportation and storing/cooling. Globally, urban agriculture has seen an increase in attention and technologies for producing produce in an urban setting have been developed. These technologies could assist the Vietnamese urban agriculture sector to continue growing while improving overall efficiency of the production system. The outlying district of Hóc Môn in HCM City plans to focus on urban farming as part of the national "new-style rural area" programme in which it takes part (Hortidaily, 2018).

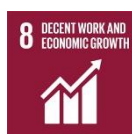


The main social-economic driver for urban farming in and around the big cities is the fast growing urban population and economic development.

Potential Dutch partners: WageningenUR, UrbanFarmers, City of Rotterdam, Platform Eetbaar Amsterdam, etc.

Waste management

Wastewater treatment agriculture and aquaculture



Water discharge from agriculture and aquaculture is often polluting the ecosystems. With regulations becoming more stringent on water discharge, there is a vast potential for wastewater treatment technologies to be implemented in the agri- and aquaculture sectors. However, funding



opportunities by government and local businesses are still limited in Vietnam (see also the chapter on 'Water management'). Linking initiatives to (Dutch) multinationals (buyers in Vietnam or in international supply chains) may offer a way forward. Note that there are Dutch-Vietnamese partnerships on both agriculture and water. The integration of both partnerships is currently being explored.

Main driver for waste water treatment in these sectors will be economic development (preserving key production factors) and access to clean water in the main production regions.

Potential Dutch partners: Suppliers of wastewater treatment knowledge and techniques in agriculture and aquaculture, like WUR, Fresh Studio, Witteveen+Bos, RHDHV, Deltares, Paques, etc. See also the chapter on 'Water management'

From waste to resources

Biomass to energy from agricultural waste streams



As an agricultural country, Vietnam has access to vast amounts of agricultural residues. Biomass waste streams can be used for several purposes such as biomass combustion or gasification. For example, the Heineken brewery in Hanoi uses its agricultural waste streams as feedstock for anaerobic digestion, which is consequently used for heat generation that is used in the brewery. Another opportunity is rice husk. Every year, Vietnam produces 23 million tons of rice straw and 8-9 million tons of rice husk. Only half of rice husk is used for domestic cooking, for ceramic/brick kilns or returned to the field as fertilizer, and recently, used in few rice husk-fired plants in Mekong Delta. NeoFin (an international project developer based in NL) is interested in forming a consortium for commercial use the rice husk, which causes pollution in Asia Pacific region, including Vietnam (for example to use rice husk for renewable energy or for production of SiO₂ to be used as additives in other industries).

Main drivers for biomass to energy investments will be a reduced dependency on fossil energy (based on the renewable energy policy in Vietnam) and improved income of farmers providing the biomass.

Potential Dutch partners: Neofin, etc. (also see 'Renewable energy').

4 LOGISTICS

4.1 Characterisation and challenges

4.1.1 Sector characterisation

Vietnam is set to see very strong growth in trade over the coming years, which will support ongoing development and expansion of its logistics. The logistics industry is one of the fastest growing industries in Vietnam, but poor infrastructure is increasing its costs. The main logistics hubs can be found in the North (Hanoi – Hai Phong area) and in the South (the wider Ho Chi Minh city area, including Dong Nai province, Binh Duong province and Ba Ria/Vung Tau. Currently, the logistics sector already accounts for 15-20% of GDP in Vietnam (Brainport Eindhoven, 2017). Particularly investments in the manufacturing industry have been driving the country's demand for international transport and logistics services. Moreover, a growing middle-class and growing population have been driving demand for domestic transport and logistics services.

Although some multinational logistics firms have started to set up business in Vietnam, the sector is still largely dominated by small-scale companies (Stoxplus, 2017). As the Vietnamese logistics sector is in an early development stage, warehousing facilities are equally underdeveloped. Warehousing facilities and container freight stations are not user friendly and are often inefficiently located (Brainport Eindhoven, 2017). Moreover, because communication between businesses is lacking, many companies keep large stock of products to account for any unplanned rise in demand. This causes an inefficient warehousing system where large inventories are stored.

Sea freight

For international transport, Vietnam relies heavily on sea freight. Since 2007, Vietnam's container port throughput has been growing with annual growth rate of 12,5% (HKTDC, 2015). With commercial and manufacturing activities traditionally being more concentrated in the south, the ports along the Mekong River Delta have traditionally been the focus of logistics industries. In more recent years, the ports in the North, for example Hai Phong port near Hanoi, have also grown significantly.

Road transport

The vast majority of domestic transport takes place via road. Estimations are that more than 80% of the goods transported within Vietnam are transported via its road system and ton kilometers per good are usually high as products are often transported from the north to the south or vice versa. Moreover, with the development of Vietnam as regional manufacturing hub, international road transport is growing as well. In total, the Vietnamese road infrastructure transports 76% of all freight transport and 94% of all passengers transported (Brainport Eindhoven, 2017).

Air transport

Air transportation in Vietnam is supervised by the Civil Aviation Administration of Vietnam (CAAV) and the airport infrastructure is developed and managed by three public companies of which the Airport Corporation is the largest. In total, Vietnam has 23 airports and in the Master Plan to 2020 the Government has to upgrade most of these existing airports and develop new airports with a total investment of USD 13.4 billion. The most important project that attracts most attention is Long Thanh International Airport. Developing greenfield airports and upgrading brownfield airports will provide many opportunities related to consultancy and planning, technology for safety, security and logistics purposes, and knowledge transfer.

Cold chain logistics

With increasing international demand for Vietnamese seafood and fruits and vegetables, the demand for cold chain logistics services are growing. In the nearby future, the demand for these goods is expected to grow further, causing that cold chain logistics has a high potential for growth. Cold chain logistics consists of cold transportation (cold container transportation and cold trucking transportation) and cold storage (Stoxplus, 2017).

4.1.2 Challenges

The logistics sector in Vietnam faces several challenges, potentially affecting a number of Sustainable Development Goals (SDGs):

Improvements in the national road infrastructure are necessary to meet the demand of the growing logistics sector

Vietnam's strong economic growth in combination with its geography creates a growing need for long-distance freight logistics. Vietnam's road system is about 258,200 km long of which 19% is paved and 40% of the network is in poor condition. Although generally the roads connecting the larger cities are in fine shape, often the roads connecting industrial zones and focal economic zones, airports and seaports are not well maintained and the road system is often subject to congestions (Brainport Eindhoven, 2017). This causes that the total logistics costs in Vietnam are relatively high compared to other peers (Stoxplus, 2017).



The logistics sector in Vietnam is dominated by small companies. Although some multinational logistics firms have started to set up business in Vietnam, the sector is still largely dominated by small-scale companies (Stoxplus, 2017).

As the Vietnamese logistics sector is in an early development stage, warehousing facilities are equally underdeveloped. Warehousing facilities and container freight stations are not user friendly and are often inefficiently located (Brainport Eindhoven, 2017). Moreover, because communication between businesses is lacking, many companies keep large stock of products to account for any unplanned rise in demand. This causes an inefficient warehousing system where large inventories are stored.

The expansion of the logistics sector has been accompanied by significant environmental impact

The heavy reliance on road transport, often undertaken by inefficient second-hand trucks caused that the growth of the logistics sector, although still at an early stage of development, has caused significant environmental impact in terms of greenhouse gas emissions and air pollution. Air pollution has become a serious health issue in Vietnam, especially in and around the big cities. Moreover, inefficient warehousing cause that the logistics sector in Vietnam is relatively energy intensive and hence enlarges its environmental impact.



4.1.3 Policy and regulation

For logistics, the outstanding circular economy issues are concerned with pollution control (of multimodal transport), service efficiency (management issues) and infrastructure development (sustainable planning). These issues are included in relevant regulations at national level and technical regulations guided by relevant ministries.

Foreign providers

There is still room for private sector (especially from foreign partner countries) to provide better management solutions, pollution control technologies and offer sustainable planning project support. According to recent international trade commitments, the logistics services are becoming more open for participation of foreign services providers, giving more chances for fair competition and better services.

The Vietnamese government has taken a proactive step to promote cold chain infrastructure by introducing financial incentives to attract foreign investment.

4.2 Circular business opportunities for Dutch companies

In the logistics sector, opportunities exist that fit within the model of a circular economy and have the potential to enhance the competitive position of the Vietnamese logistics sector. Dutch companies can either set up their operations through a Vietnamese entity to provide logistics services in Vietnam or participate in parts of the supply chain of services. The following opportunities were identified that have the potential to enhance the circularity of the sector and to contribute to the SDGs currently at stake:



Figure 6. Circular business opportunities in the Vietnamese logistics sector

The opportunities are explained below, including the social-economic challenges/SDGs which may serve as a driver to take action.

Raw materials

Recycled plastic collection, sorting and production

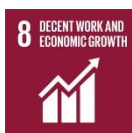


The plastics industry is high on the agenda of the Vietnamese Government and the Ministry of Industry has established several key investment programs with the aim of stimulating growth specifically in the production of high-tech plastic parts and developing the recycling industry. Vietnam is home to an astonishing 2,800 craft villages that include not just those that make handicrafts for tourists, but some that specialize in recycling all sorts of discarded plastic, including from waste streams. Residents of these villages buy plastic from traders or directly from waste pickers and process it into plastic pellets or film that can then be used to make new plastic products. Main social-economic drivers for investments in plastic recycling will be economic development by professionalising current recycling practices and improving collection from, for example, coastal tourist destinations (also see the chapter on 'Water management').

Potential Dutch partners: Recycling companies, such as: SUEZ, QCP, UPP! UpCycling Plastic, Lankhorst, etc.

Production

Sustainable packaging



The logistics sector, related to export and the growing local market, is one of the fastest growing sectors. With its growth, several related sectors are growing in conjunction. The packaging sector is one of these sectors that is growing fast but receiving little attention in Vietnam. Packaging services are basic in Vietnam and packaging material is excessively used. Therefore there is a good potential for a service provider of packaging services to step into this vacuum and offer sustainable packaging services.

Social-economic challenges driving the interest in sustainable packaging concepts will be economic development through innovation opportunities and improved shelf life of perishable products.

Potential Dutch partners: Hordijk, Dillewijn, Van der Windt, Smart Packaging Solutions, Rodenburg Biopolymers, etc.

Climate controlled logistics (cold chain) and technologies

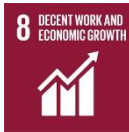


After signing CPTPP, EVFTA Vietnam will focus more on export, especially aquaculture and horticulture products therefore the demand for cold storage will increase. Vietnam already exports a lot of seafood, vegetables, flowers and also imports processed food products and pharmaceuticals. This creates a high demand for climate controlled logistics services. Business opportunities arise for suppliers of sustainable climate controlled logistics. Efficient climate controlled logistics can increase the efficiency of the logistics while decreasing inputs and losses during the logistics process. Moreover, foreign retailers are interest in Vietnam's market and its expected blooming of supermarkets / shopping malls, which creates more demand for cold storage as well.

Main social-economic driver will be economic development through export development and a reduction of product losses.

Potential Dutch partners: Cold chain technology and service suppliers, such as: Kloosterboer, CoolPack, etc.

Warehouse Management Systems



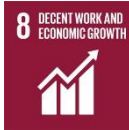
Most warehouses in Vietnam are managed inefficiently, with companies keeping large inventories. Warehouse Management Systems and software can significantly improve the current warehousing practices in Vietnam. Enhanced warehousing systems can cause smaller inventories to be kept which can significantly reduce the environmental impact of the goods sold. Friesland Campina in Vietnam has implemented a Warehouse Management System in its transportation hubs and have announced that this has significantly improved the efficiency, and thereby reduced the energy intensity, of their logistics system.

Main driver for investments in warehouse management will be improved profit margins, though for companies with strong CSR policies in place (e.g. Dutch multinationals), the environmental benefits may also drive innovation.

Potential Dutch partners: Vanderlande, etc.

Consumption / use

Fuel efficient and electric mobility (trucks and buses)



Overall, fuel efficiency of trucks used for logistics in Vietnam is low. Often dated, second-hand trucks are used for the transportation of goods over road. Currently, fuel prices in Vietnam are relatively low, and hence there are limited economic incentives for investing in fuel-efficient trucks. Government regulations on air quality might help to develop the market for cleaner trucks. A key driver for fuel efficient and electric mobility will be the growing negative health effects of air pollution, especially in Vietnam's big cities and economic development by improving the efficiency of transportation (reduced congestion in and around cities).

Potential Dutch partners: DAF Trucks, VDL Bus and Coach, etc.

Sustainable airport development



Aviation and airports are a growth sector in Vietnam. In the coming years, Vietnam will have to significantly increase the capacity of its airports. Increasing the capacity of its airports will require significant investments into the airports. By including the concept of circularity to these planned developments, Vietnam can develop its airports in a sustainable way. Possible circular opportunities are: circular building, baggage handling systems, light as a service, waste collection, recycling and bio-fuel.

Main drivers for such investments will be economic development (more cost-efficient systems) and Vietnam's policy on renewable energy.

Potential Dutch partners: Schiphol Group, Vanderlande, NACO, Philips Lighting, The Waste Transformers, etc.

Sharing platforms



The Sharing economy describes economic and social activities, involving online transactions in an open-source community. It usually refers to peer-to-peer sharing via an online market place. The sharing economy may take a variety of forms, including using information technology to provide individuals with information, that enables them to optimise resources through an effective use of excess capacity. The arrival of Uber and Grab — a Singaporean transport app very popular in Southeast Asia — to the market in the last two years has put traditional taxi drivers, generally made up of men with few resources, under threat. Local sharing platforms can also have a positive effect on Circular Economy and the local Vietnamese economy. Social-economic driver for investments in sharing platforms will be the focus on smart city development, the improved access to services (reducing inequality) and economic development through smart solutions (e.g. reducing congestion in cities through car sharing).

Potential Dutch partners: Sharing platforms, such as: Floop2, Peerby, Snappcar, etc.

Waste Management

MSW – Municipal Solid Waste management services



In Vietnam, a country with a numerous population and growing economy, solid waste management has become a serious issue, attracting the attention of the local government and businesses. Urban Environment Company (URENCO) organises about 70–80% of the national waste collection, while the rest has been collected and managed by local small- and medium-sized sanitation companies.

Main social-economic drivers for investments in waste management will be health hazards currently faced by people in craft villages (see also the chapter on Smart Cities) and access to clean water (by limiting water pollution) and economic development (professionalising of the waste collection system).

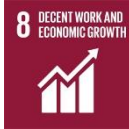
Potential Dutch partners: Waste management companies, such as: AEB, SUEZ, Bollegraaf Recycling Machinery, etc.



Figure 7 & 8. Black Bear (carbon black from car tires) and Closing the Loop (mobile phone recycling)

Waste to resources

Recycling of used (automotive) products (such as: cars, tires and e-waste)



The majority of domestic and regional transport in Vietnam takes place via the road in trucks. This not only causes enormous environmental impacts, but also produces waste streams. Waste tires is a waste stream from trucks that can be collected and recycled. With the vast annual quantity of waste tires being available in Vietnam, setting up a waste tire recycling facility in Vietnam shows good business potential.

Drivers to invest will be economic development (new business) and health benefits through the reduction of health hazards in the recycling of e-waste in the informal sector in craft villages.

Potential Dutch partners: Recycling companies, such as: Black Bear, Granuband, ARN, CEYES Circular Experts, Closing the Loop, etc.

5 RENEWABLE ENERGY

5.1 Characterisation and challenges

5.1.1 Sector characterisation

The energy economy in Vietnam is changing rapidly

Vietnam has a large range of primary energy sources such as crude oil, coal, natural gas and hydro power. In 2015, the primary energy supply in Vietnam consisted of 35% coal, 28% oil, 14% natural gas, 17% biomass and 6% hydro (MoIT, 2017). In terms of sectors, the industrial sector is the main consumer of primary energy (43%), followed by the residential sector (29.6%) and the transportation sector (22.7%). Figure 9 shows the relative development of these primary energy sources during the period 2006-2015. From this figure it can be concluded that while the importance of biomass in the primary energy supply is decreasing, the importance of electricity in the primary energy supply is rapidly growing.

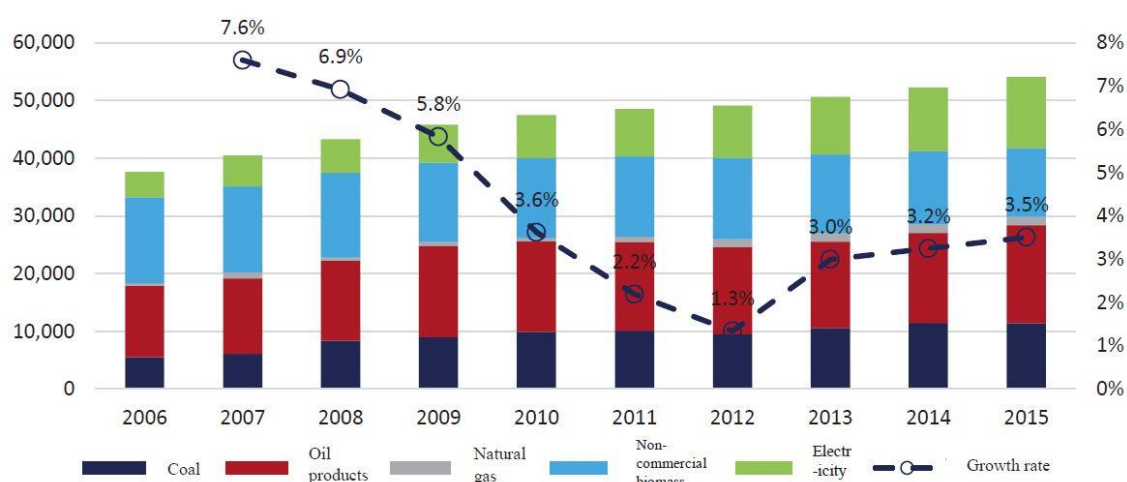


Figure 9. Progress of primary energy supply in the period 2006-2015 (MoIT, 2017)

Vietnam has become a net importer of power

Traditionally, Vietnam has been exporting energy. In recent years energy export has declined and coal imports have increased. The growing demand for energy in Vietnam has caused that Vietnam cannot satisfy its own energy demand and has started to import coal to burn in coal-fired plants for the production of electricity. Because of this shortage, Vietnam is a net importer of energy since 2015 with a net import rate of about 5% of the total energy supply (MoIT, 2017).

Demand for electricity is rapidly growing

Due to both rapid industrialization and remarkable economic growth, domestic energy consumption levels have increased at almost double the speed of GDP growth. During the period 2005-2014, average annual growth in electricity demand was 12.1%, and peak demand grew from 9.5 GW to 22.2 GW (ADB, 2015). The electricity consumption per capita has increased from approximately 1,000 kWh to 1,500 kWh per annum in the period 2010-2015. Figure 4 shows the relative growth of electricity as part of the primary energy supply. Different estimations of energy demand in Vietnam vary from increasing threefold to eightfold from 2015 to 2030. The industrial sector is the largest consumer of electricity (53.9% in 2014). Other off-

takers of electricity are the residential sector (35.6%), the commercial sector (4.8%), the agricultural sector (1.5%) and other sectors (4.3%).

The Vietnamese electricity grid is largely dependent on coal- and hydro power

In 2015, the total installed capacity in Vietnam was 39,000 MW. Of this 39,000 MW of installed capacity, 41% derived from hydro power (16,075 MW), 33% derived from coal-fired power (12,751 MW), 22% derived from gas and oil fired power (8,501 MW) (MoIT, 2017).

Almost all households in Vietnam are attached to the national grid

Vietnam has made remarkable progress in terms of energy access. Energy access increased from 50% in 1995 to 98% in 2014 (ADB, 2015). The last 2% lives in very remote and often mountainous areas that are hard to reach with extension of the grid. Even though the electrification rate is high, there are still large parts of the country that suffer from poor energy services, with power cuts occurring frequent (estimation 20%).

The Vietnamese power sector is dominated by the EVN

The Vietnamese energy sector is led by the MoIT and dominated by large-scale State-owned Enterprises (SoEs). Electricity Viet Nam (EVN) controls most of the power generation as well as distribution (Neeffjes, 2017). Other important SoEs in the energy sector are VINACOM (coal mining and coal trading), PetroViet Nam (Oil and Gas) and Petrolimex (Petroleum). Following a restructuring process of deregulation and privatization under the electricity law 2005, EVN was transformed from a traditional SoE into a holding group in 2006. Following this restructuring process, there are no restrictions on foreign ownership of electricity generating companies in Vietnam. Nevertheless, EVN still remains the main actor in the power sector of Vietnam with a very limited share of the installed capacity being owned by private investors (Hoang et al, 2016).

Electricity prices are set below cost price

Although prices for electricity have increased steadily, they do still not reflect the actual costs of the energy system. It is estimated that the funding shortfall is between 20% and 30% (GIZ, 2015). As a consequence, EVN operates at a loss. The current pricing system for households is based on an increasing price for each additional 50 kWh consumed per month. The first 50 kWh per month are priced at 1,484 VND / kWh (\$0,065), increasing up to 2,503 VND (\$0,11) / kWh from 300 kWh per month and up. For commercial off-takers, the pricing system distinguishes between the manufacturing sector and the business sector. For commercial clients, tariffs are set based on the time of consumption (normal/peak/low) and the voltage of the connection. On average, the prices for the manufacturing sector are lower and the prices for the business sector are similar to the prices for households.

Vietnam has good potential for renewable energy

Although the current development of non-hydro renewable energy in Vietnam is low, the country has significant renewable energy potential. In terms of the potential for solar, the south has the largest potential with annual solar irradiation similar to Spain (Neeffjes, 2017). However, also the north of Vietnam shows sufficient potential for solar dissemination, with annual solar irradiation similar to Germany.

Vietnam is considered to have the best wind resources in Southeast Asia. Therefore Vietnam has great potential to develop and generate wind energy. Both on- and off shore wind show good potential with sufficient wind year round. Especially the southern-central provinces and the Mekong delta show good conditions for the development of wind power. The total potential for wind energy in Vietnam is estimated at 8,000 MW (Vietnam Briefing, 2017).

Vietnam's agricultural activities cause that vast amounts of biomass are available. Therefore, the country has a relatively high potential for biomass energy generation in the form of agricultural waste. Especially the Mekong Delta region and Red River Delta region possess vast amounts of agricultural waste streams (respectively 50% and 15% of the country's total agricultural waste) (Embassy of the Netherlands in Hanoi, 2017). Some of the main agricultural waste streams with potential for energy generation are rice husks, coffee husks, and bagasse. The total current installed capacity of biomass to energy is 352 MW, while the potential is estimated at 2,000 MW (Vietnam Briefing, 2017).

Small hydro power generation (up to 30 MW) still provides significant potential. Vietnam has largely exploited its potential for large-scale hydro power generation. In Vietnamese legislation, hydro power generation with an installed capacity below 30 MW is regarded as a renewable energy source, while large-scale hydro is not a renewable energy source. The potential for hydropower in Vietnam is concentrated around its 10 major river systems.

An overview of the current installed capacities and potential capacities of the different renewable energy sources is presented in table 1.

Table 1. Current installed capacity and potential of different sources of renewable energy (adapted from Vietnam Briefing, 2017 and ADB, 2015)

Source	Current installed capacity	Potential
Solar	4 MW	4-5 kWh/m ²
Wind	146 MW	8000 MW
Biomass	352 MW	2000 MW
Small hydro*	1984 MW	7200 MW

* Up to 30 MW

5.1.2 Challenges

The renewable energy sector in Vietnam faces several challenges, potentially affecting a number of Sustainable Development Goals (SDGs):

Environmental and health impacts from coal-fired power plants

The rapid expansion of Vietnam's energy sector has been accompanied by significant environmental impacts. Especially the growth of coal-fired power plants in recent years worsens environmental and health concerns (see also the section on 'Smart Cities').



Environmental threats from agricultural biomass

While biomass is currently underdeveloped as source of electricity, many households in rural areas still use biomass fuels such as fuel wood, agricultural residues and charcoal as cooking fuel. Moreover, biomass fuels are an important source of energy for small industries located mainly in rural areas. Many of the feedstocks are not only available, but also currently represent a threat to the environment. Rice husk, rice straw, coconut pith, sugar cane bagasse and coffee waste: these waste flows are currently not being dealt with in an



environmentally sound manner, e.g. directly flushed into waterways or dumped. The utilization of these resources is therefore a business opportunity as well as an environmental benefit. Rice straw can be said to have the largest potential in this respect, but at the same time also poses the greatest challenge (from 'Biomass Opportunities in Vietnam', RVO, 2013).

Feed-in-Tariffs in Vietnam are one of the lowest in the world

Feed-in-tariffs (FiT) for the inclusion of renewable energy in the national grid are proposed by the Ministry of Industry and Trade (MoIT) and decided upon by the prime minister. Currently, there are FiT in place for different renewable energy sources. The FiT however, are not at market price level and are one of the lowest FiT globally. A summary of the FiT in place in Vietnam is presented in table 2.

Under the latest FiT for solar power that came into force on June 1st 2017, net-metering for residential solar has become possible. This implies that rooftop solar PV systems can benefit from bi-directional metering. The excess power that is generated can be sold to the grid at the same price as the solar FiT (\$0,093 / kWh) (Brohm, 2017).



Grid-connected energy projects are often not-bankable for foreign investors

The Vietnamese power sector is not easily accessed for foreign investors. First, the current FiTs are modest and do not provide a serious investment potential for private actors (see table 2). Secondly, projects where electricity is generated and fed into the national grid are often not-bankable because banks are hesitant to provide loans to energy projects in Vietnam (because of the assumed country risk and EVN not being regarded as a creditworthy off-taker). Development banks, like the Dutch development bank FMO, may offer an alternative way of investment, accepting higher levels of risk and lower financial returns compared to traditional banks and focusing on investments that show a clear environmental and/or social return.



Table 2. Current FiT in place (adapted from Vietnam Briefing, 2017 and ADB, 2015)

Source	FiT	Remark
Solar	\$0,093 / kWh	FiT in place until June 30, 2019
Wind	\$0,078 / kWh	
Biomass	\$0,058 / kWh	For co-generation
Small hydro*	Annual avoided cost tariffs issued by MoIT.	For 2017 approximately \$0,050 / kWh

5.1.3 Policy and regulation

At national level targets and legal frameworks have already been in place for renewable energy and energy efficiency creating opportunities for participation by different stakeholders, including private sector and foreign investors. In 2016, the Government issued Decision No. 2068 on Renewable Energy Development Strategy towards 2030 with an outlook to 2050.

Other policies relevant from a renewable energy perspective include:

- Law on Energy Saving and Efficiency, providing incentives for energy efficiency and conservation as well as cleaner production measures.
- Revised Power Development Plan number VII
 - Setting targets to reduce energy intensity (computed in terms of elasticity of growth in demand for electricity against GDP growth)
 - Promoting the introduction of smart grids. A smart grid roadmap was approved in November 2012 stipulating completion of high-voltage supervisory control and data acquisition, introduction of advanced metering infrastructure and other smart grid technologies at the distribution level, integration of distributed renewable energy, and development of the necessary regulatory frameworks (source: ADB energy roadmap 2015).
 - Increasing the share of renewable energy to around seven percent in 2020 and above 10 percent in 2030 and reducing the use of imported coal-fired electricity to ensure energy security, climate change mitigation, environmental protection, and sustainable socio-economic development.
- Vietnam Green Growth Strategy, accelerating the process of economic restructuring in order to use natural resources efficiently, reduce greenhouse gas emissions through research and application of modern technologies. The Strategy mentions tax policies, financial measures on land-use, and CDM policies to achieve low-carbon growth, greening of production and greening of life-styles.

5.2 Circular business opportunities for Dutch companies

A circular economy is powered by renewable energy. The following opportunities were identified that have the potential to enhance the circularity of the sector and to contribute to the SDGs currently at stake:

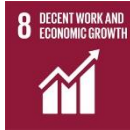


Figure 10. Circular business opportunities in the Vietnamese renewable energy sector

The opportunities are explained below, including the social-economic challenges/SDGs which may serve as a driver to take action.

Raw materials

Consultancy services on renewable energy resource mapping



The exact mapping of resources for energy generation (such as biomass) can help get a better understanding of the different potential sources of renewable energy and spark business interest. Biomass availability: the following biomass resources are not only available but also are of harm to the environment at the moment: rice husk, rice straw, coconut pith, sugar cane bagasse and coffee waste. The utilization of these resources creates opportunities and will benefit the environment. Rice straw can be identified as the largest potential, but at the same time also the most challenging.

Reasons to invest in such services can be found in Vietnam's policy on renewable energy and providing an additional source of income to rural communities.

Potential Dutch partners: Consultancy firms like SNV, WUR, RHDHV, DEKRA, CREM, Partners for Innovation, etc.

Production

Biogas and Biofuel production



Biogas is one of the fastest growing sectors in Vietnam. This automatically results in a larger demand for upstream and downstream equipment. Densification (pelletizing, briquetting) technologies, as well as combustion and (co-)generation technologies are not widely available in Vietnam. Supply of technology as well as knowledge is desirable.

Main driver for investment will be Vietnam's policy on renewable energy and the access to affordable energy.

Potential Dutch partners: Organisations involved in biogas programs in Vietnam and Providers of biogas technology, like SNV, Nexus, Royal HaskoningDHV, Sweco, Paques, Biogas Holland, etc.

Improve energy efficiency



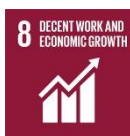
Energy efficiency in Vietnam a largely underdeveloped concept. Significant benefits can be obtained by using energy efficient technologies in the Vietnamese industry. With rising energy tariffs, energy efficiency can provide a good business opportunity for the growing manufacturing industry. The Vietnamese manufacturing industry is relatively energy intensive and hence business opportunities arise for providers of energy efficient technologies and services to enhance energy efficiency.

Main drivers for investments will therefore be cost savings / economic development and a reduction of the dependency on fossil energy.

Potential Dutch partners: Energy efficiency experts like ECN and BlueTerra Energy Experts, DWA, etc.

Consumption

Solar PV with net metering



For companies, the net metering legislation could make it *feasible to produce electricity using solar PV, selling the surplus to the national grid*. The solar rooftop can be exploited by the company itself. Moreover, there is a business opportunity for a service provider offering the services of exploitation of the rooftop solar plant to the off-taking company.

An additional focus within the use of PV systems in Vietnam can be the recovery of rare metals from discarded PV systems. The growing use of PV systems is expected to create a growing scarcity of metals used within these systems.

Social-economic drivers for investments in solar PV are the access to affordable, green energy and, in case of solar for (large) businesses, climate action and economic development.

Potential Dutch partners: Kamworks (based in Cambodia)

Consultancy services on the energy transition



There is a lack of awareness and knowledge on the implementation of renewable energy in the Vietnamese energy sector. Both on the private and on the public level, advice on how to implement the energy transition is required.

Related social-economic drivers include access to affordable green energy and the need for climate action.

Potential Dutch partners: ECN, Ecofys, Partners for Innovation, Marge, Ingenia, etc.

Improved Cookstoves



On a household level, the introduction of improved cookstoves is a sustainable business opportunity for both NGOs, knowledge partners as well as commercial parties. The EnDev (Energising Development) partnership is directly relevant in this respect. EnDev is an energy access partnership currently financed by six donor countries: the Netherlands, Germany, Norway, United Kingdom, Switzerland and Sweden. EnDev promotes sustainable access to modern energy services that meet the needs of the poor - long lasting, affordable, and appreciated by users. EnDev works in 25 countries in Africa, Asia and Latin America. The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) cooperates closely with the Netherlands Enterprise Agency (RVO) on the global programme level.

Social-economic drivers to focus on improved cookstoves is not only the reduction of greenhouse gas emissions and reduction of deforestation, but also improved health of households where the cookstoves are used.

Potential Dutch partners: Global Alliance for Clean Cookstoves, RVO, cookstove service and technology providers like: SNV, TU Delft, Fair Climate Fund.



Figure 11 & 12. Biogas small installation (SNV) and industrial production plant (Bio2Watt)

Waste to resources

Captive business models in biomass to energy



Vietnam has vast amounts of agricultural waste streams that could potentially be used as a means of producing renewable energy. From the current characteristics of the Vietnamese electricity sector, generating power for the national grid will probably not generate business interest. However, there is a potential for generating renewable energy for a single commercial off-taker. As the current energy market hurdles the development of private sector electricity sales to the grid, a captive model where the producing company sells all energy produced to one off-taker (that might be willing to pay more than the cost of electricity from the national grid on the basis of sustainability) might show to be feasible.

Social-economic drivers include climate action, rural income generation and responsible production practices.

Potential Dutch partners: Biomass to energy service and technology providers like: Platform Bio-energy, Kara, BTG, HoSt, Biogas plus, Enki Energy BV, Serigas International, Fuenix, Biopower International BV, etc.

Municipal Solid Waste (MSW) to energy



Management of solid waste, including the municipal solid waste (MSW), is a major challenge in urban regions of most part of the world, including Southeast Asia. Due to the lack of effective management programs, regulations, and policies; the waste is causing severe health hazard including several communicable diseases, bad odors, nuisance, and environmental impacts, such as, contamination of water, soil, and air. In Ho Chi Minh City, about 8,175 tons of solid waste was generated per day in 2014, consisting 6,800-7,000 of MSW, with 1.02 kg/capita/day generation of waste. The MSW of Ho Chi Minh City contains 65-90% biodegradable matter, that could be digested to biogas and compost. The current common practice of solid waste management in Ho Chi Minh City is landfilling (from 'Municipal Solid Waste Management in Ho Chi Minh City, 2016). Although it is the least preferable circular option, waste to energy can be a solution for all the non-recyclable waste streams, that is better than landfill and plastics ending up in the oceans.

Social-economic drivers to invest in waste-to-energy know how and technology are the negative impacts of landfill (land use and pollution of ground water), health hazards and the focus on renewable energy.

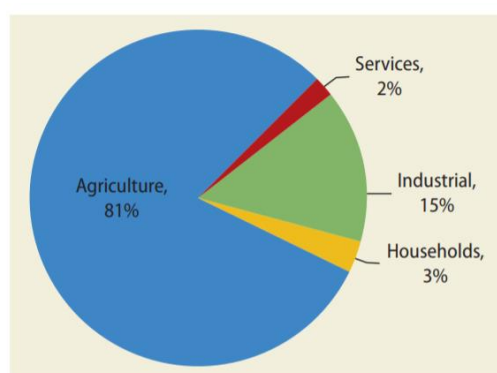
Potential Dutch partners: Waste management service and technology providers like AEB, Orgaworld, Host, etc.

6 WATER MANAGEMENT

6.1 Characterisation of the sector and challenges

6.1.1 Sector characterisation

A large percentage of Vietnam's GDP depends on water. It is of primary importance for food and health and contributes as a major resource for economic activities. Water sustains the agricultural and industrial sectors, including energy production, logistics/navigation and tourism. Water use in Vietnam by different sectors is as follows (figure 13, World Bank Group, Ministry of Planning and Investment of Vietnam, 2016):



Source: General Department of Irrigation 2013.

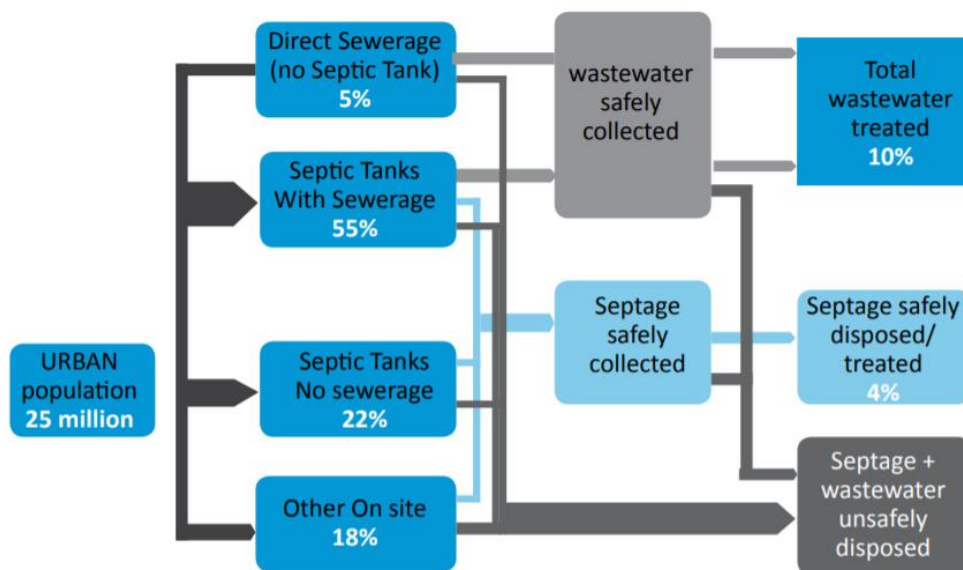
Figure 13. Water use by different sectors in Vietnam (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016)

Urban sanitation in Vietnam is guided by a number of ministries and agencies, including the Ministry of Construction (MoC), Ministry of Health (MoH), Ministry of Natural Resources and Environment (MoNRE) and Ministry of Science and Technologies (MoST). Overall responsibility for the sector falls under MoC, although work is increasingly being decentralised to the provincial public service providers at the municipal level (WEPA, 2013). Most of the costs for operation and maintenance of drainage and wastewater treatment systems are covered by provincial or city budgets; however, this budget is only sufficient to meet about 10–20% of O&M costs for collection systems, and excludes O&M costs of wastewater treatment plants. Revenue for wastewater operations is mostly generated by application of a wastewater surcharge on the water bills for all customers (WEPA, 2013).

In Vietnam, most of the urban areas in category IV or higher have combined sewerage and drainage systems, which collect both rainwater and wastewater via pipeline collection networks or drainage canals. According to the Ministry of Construction, before Nov. 2013 only eight urban areas in Vietnam had centralised wastewater treatment plants, mainly in big cities including Hanoi, Ho Chi Minh City, Da Nang, Quang Ninh, Da Lat, Buon Ma Thuat, Bac Giang and Phan Rang. However, in recent years a large number of decentralised wastewater treatment plants have been constructed in both large and medium-sized urban areas such as Hanoi, Bac Ninh, Vinh and Can Tho under support from the Vietnam Government and a number of international organisations (WEPA, 2013).

Domestic waste water

Domestic wastewater from households is mainly treated in a household's septic tank before being discharging into combined sewer systems, then into rivers, lakes, and canals without any further treatment, except in some big cities such as Hanoi and Ho Chi Minh City (figure 8). Nearly 90% of households in urban areas have septic tanks. The remaining households are either equipped with other type of onsite sanitation such as double vault composting toilet (DVCT), pit latrines or directly discharge their wastewater into combined sewers without any treatment (WEPA, 2013). An overview of urban waste water management is presented in figure 14.



Source: World Bank, 2013

Figure 14. Status of urban wastewater management in Vietnam (Australian Aid, World Bank, 2013)

Following the Vietnamese government's policy, state management agencies are assigned to play the major role in the management of the country's water resources. However, there is increasingly room for other agencies and actors to operate in and influence the water sector. Private sector participation and foreign direct investment (FDI) are limited but on the increase, mainly in water related businesses such as hydraulic engineering companies, hydraulic construction companies, and water supply and sewage companies. Other areas of water-related business operation include maintenance and repair services, production (fishery, aquaculture etc.), trading (pump sellers etc.), consulting and education & training services. On a practical level, the Netherlands has been active in developing sustainable water production and supply systems, as well as methods of collecting, treating and reintroducing 'used' water. Now that Vietnam has become a middle-income country, the nature of that cooperation is moving towards private sector engagement (Website 'Tomorrow is Green', 2017).

6.1.2 Challenges

The water sector in Vietnam faces several challenges, potentially affecting a number of Sustainable Development Goals (SDGs):

High level of water pollution

Water pollution is one of the most serious environmental issues. The large amount of wastewater from aquaculture production in the south threatens water quality in the Mekong Delta. Problems in managing water quality—especially the polluting effects of fertilizer and agrochemical runoff—exist in some rural areas. However, urban wastewater is the largest contributor to water pollution in many parts of the country. Over the next 15 years urban wastewater is expected to account for the largest share of effluents (about 60 percent). Industrial wastewater (25–28 percent) and rural wastewater (12–15 percent) follow. The sections of rivers flowing through urban areas are heavily polluted, and many have turned into sewage or dead rivers. Wastewater treatment in most residential areas in HCMC, both new and old ones, is an exception. This increases both water pollution and the risk of water-borne diseases. Major industrial contributions to water pollution are chemical, oil refining, and food processing industries (Van Leeuwen, 2015). This means that now and in the future, sanitation and wastewater collection and treatment will be critical for improving water quality. A small share of urban wastewater is treated (10 percent), and an even smaller share (4 percent) of septage (septic tank sludge) is safely disposed. Only in Hai Phong are septic tanks regularly emptied. Fewer than half the hospitals in Vietnam have proper wastewater treatment systems. (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016).

Industrial zones discharge an estimated 1 million cubic meters of untreated wastewater a day directly into receiving water bodies. That equals about 70 percent of the country's total industrial effluent discharges. High pollution levels have severe implications for human health and natural ecosystems. They are also constraining urban development and the sustainability and future growth of industry and agriculture, thereby also impacting economic growth. The rapid increase of water use for urban, industrial, and agricultural activities in HCMC has resulted in depletion of groundwater and severe pollution of both groundwater and surface water. Current and future water supply in HCMC is at risk (Van Leeuwen, 2015).

Over half of the plastic that enters the ocean comes from just five rapidly growing economies—China, Indonesia, the Philippines, Thailand, and Vietnam (Ocean Conservancy and Mc Kinsey Center for Business and Environment, 2015). For Vietnam, this is the result of an estimated 1,83 million metric tons of plastic being mismanaged in coastal areas. This waste can eventually enter the ocean via inland waterways, wastewater outflows, and transport by wind or tides (Jambeck et al, 2015).



Low level of water efficiency and growing water stress

Sectors such as textiles, food processing, and leather estimate an average savings potential of 30 percent for water without major investments in infrastructure. Based on government surveys, only 11 percent of industrial facilities in Vietnam were using cleaner production techniques to reduce their energy, fuel, and materials consumption in 2010, pointing to much room for improvement (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016).



Overexploitation of groundwater in HCMC for domestic and industrial lowers the groundwater table and has major implications for the quality of groundwater as a result of salt intrusion. It also leads to water shortage during the dry season in HCMC. Cities in the river basin are currently under water stress and water stress will soon become critical; this will also affect the hydro power supply of these cities. Water stress will negatively impact local economic development and human well-being in general (Van Leeuwen, 2015).

Lack of sewage treatment and limited connection to central water supply system in HCMC

Water supply coverage in HCMC increased from 52% in 1997 to 84% in 2004, but the proportion of households in HCMC connected to the main water supply system is still low as a considerable number of households still obtains water from wells (34%) or small private water providers (19%). Drinking water quality is generally good, when prepared from surface water, but drinking water prepared from groundwater may have a questionable quality (Van Leeuwen, 2015)



The country faces an urgent need to achieve universal access to sanitation in urban and rural areas, for environmental and health reasons. Sewage treatment levels need to be raised substantially from the 10 percent of recent years (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016). Sludge from treated sewage in HCMC is not allowed to be used for agriculture. This is probably caused by high concentrations of POPs, heavy metals, and pathogens. Energy recovery and nutrient recovery from waste water is absent or close to zero in HCMC (Van Leeuwen, 2015). An ORIO financed project in Binh Duong shows that this may differ in different regions. In the project, organic sludge from a wastewater treatment plant is being used to produce fertilizer, and the inorganic waste sludge is used to make baked-brick.

Climate change risks and salinity intrusion

Climate change will sharply increase salinity intrusion in coastal areas. Salinity intrusion is already occurring during the dry season, hurting crop yields appreciably. Climate change and sea-level rise will affect yields and production of key crops, such as rice, maize, cassava, sugarcane, and coffee. In the Mekong River Delta, aquaculture is particularly important for employment and rural income. Higher temperatures, greater storm frequencies, increasing sea levels, and other effects of climate change are likely to affect fish physiology,



ecology, and aquaculture operations. The main effects of climate change on aquaculture are likely from increased flooding and salinity. Moderate and major shrimp producers may pay more for pumping water to maintain water and salinity levels.

Increased tropical cyclone intensity, sea-level rise, and coastal flooding are projected to affect coastal cities, where increasingly large populations and assets are exposed to climate change risks (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016).

Dependency on external (ODA) funding and lack of cost recovery in urban sanitation and wastewater treatment

The growing investment in urban sanitation and wastewater treatment in both large and medium cities has primarily been supported by Official Development Assistance (ODA) funding. Little has been done to achieve cost recovery, e.g. through wastewater tariffs paid by households. The majority of local authorities seem willing to continue to subsidize operations. Inadequate tariffs and the lack of an effective regulatory system are principal barriers for private sector entry (Australian Aid, World Bank, 2013). The sector in Vietnam is not yet sufficiently developed to take on energy and resource recovery in waste water treatment without any donor funding (RHDHV, NWP, 2018). This negatively affects challenges like the access to clean water, health standards and reduced economic development through water scarcity.



Regulatory challenges

Apart from the socio-economic challenges Vietnam also faces some regulatory challenges:

- The system of state management of the water sector has not proved its worth yet in formulating and ensuring its effectiveness in a coordinated manner. Vietnam has still not achieved adequate consistency and coordination of the systems of policies, laws, standards and norms in the domain of water resources for the sustainable development of the water sector. (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016)
- Presently there are no national laws governing the collection and treatment of septage, and the national government has no mandate for septage management or policy guidance. Therefore, all desludging operators in urban areas are only required to obtain a business license before starting operations. As a result, local governments have no incentive to promote septage management, invest scarce resources in operating treatment facilities, or support such projects once ODA project funding dries up. (WEPA, 2013)
- Among the shortcomings of Vietnam’s regulatory system are policies that promote industrial growth without considering environmental pollution. Another deficiency is limited resources—personnel and funding—for environmental monitoring. Failings are evident in insufficient enforcement because of corruption and inadequate resources. Other shortcomings are low penalties for noncompliance and little public disclosure of industrial pollution information. (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016)
- The lack of irrigation water pricing means there are hardly any incentives to cut water use or adopt technologies to that end. Changing regulations and standards since the first standard was issued in 1995 have created uncertainty among local governments for designing and implementing wastewater projects. Low water tariffs (which limit public-private partnerships and self-financing by water and wastewater utilities) have resulted in the private sector

being minimally involved in wastewater. The absence of an effective regulatory system for private investments has the same outcome. (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016)

6.1.3 Policy and regulation

The following policies and regulations are important references for business that want to act on circular economy opportunities in the water management sector:

- Law on Environmental Protection, promulgated November 29 2005, effective July 2006.
- Two government decisions set a target of supplying clean water to all urban cities and towns and limiting the rate of water loss in these cities to less than 15 percent by 2025: Decision 1929/QD-TTg on the 'Orientation for Development of Water Supply in Vietnam's Urban Centers and Industrial Parks Leading to 2025, and Vision for 2050' and Decision 2147/QD-TTg on approval of the 'National Unaccounted for Water and Nonrevenue Water Reduction Program to 2025'. (Export.gov, 2017)
- Decision 1930/QD-TTg on the 'Orientation for Development of Water Sewage and Drainage Systems in Vietnam's Urban Centers and Industrial Parks Leading to 2025, and Vision for 2050'. (Export.gov, 2017)
- Decree No. 80/2014/ND-CP dated August 06th 2014 on Drainage and Wastewater Treatment.

6.2 Circular economy opportunities

Circular economy strategies related to water management can contribute to mitigating many of the environmental and socio-economic challenges described, e.g. by enhancing the re-use of water (reducing water stress), waste water treatment and recovering nutrients from waste water (reducing water pollution). To limit the scope, this scoping study focuses on water management related to elements of 'Water smart cities', including wastewater treatment and drinking water production. Resource-efficiency measures like rainwater harvesting, prevention of leakage/water loss, water-efficiency measures and a reduction of consumption are also part of a transition towards a circular economy (see the definition in chapter 1), but already receive attention in Vietnam (e.g. activities of Vitens Evides International in HCMC).

A 'water smart city' is an approach to integrate sustainable urban planning and water management to minimise the hydrological impacts of urban development on the surrounding environment (WUR, Deltares et al, 2016). The concept is illustrated by figure 15.

Several of the 'water smart city' solutions can be labelled as circular approaches, including the restoration of the natural drainage capacity of cities by introducing nature based solutions (replacing technical solutions and reducing resource input) and closing the urban water cycle (including water storage, water treatment, water reuse and wastewater effluent reuse).

Opportunities with regard to climate adaptation, e.g. through the 'Mekong Deltaplan', will already be addressed by the Dutch businesses participating in these ongoing and long term cooperations between the Netherlands and Vietnam. The same is true for a focus on desalinization (resulting from water use and climate change), which is also part of the Mekong Deltaplan initiative.

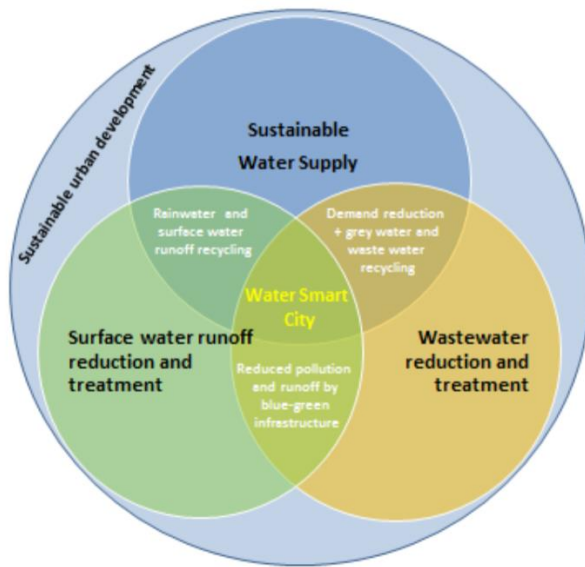


Figure 15. The concept of a water smart city (Towards Water Smart Cities, WUR, Deltares, University of Copenhagen, Climate-KIC and AMS, December 2016)

The following opportunities were identified that have the potential to enhance the circularity of the sector and to contribute to the SDGs currently at stake:



Figure 16. Circular business opportunities in the water management sector in Vietnam

The opportunities are explained below, including the social-economic challenges/SDGs which may serve as a driver to take action.

Overall view of the opportunities

The Netherlands Water Partnership (NWP) and Royal HaskoningDHV have a long standing experience in water management in Vietnam and a good overview of Dutch water management related activities. Both organisations believe that, although there is a lot of potential value in circular concepts in water management, the water sector in Vietnam is probably not yet ready for this. The market for 'traditional' water management (like industrial and urban waste water treatment), is already a challenge for Dutch service and technology providers. Dutch knowledge and technology is of high quality, but relatively costly. Entering the market often needs to go hand in hand with the provision of funding, which is difficult. Japanese and Korean companies tend to have a stronger market position than Dutch companies.

This means that, at this moment in time, circular economy related opportunities in water management in Vietnam should be seen as opportunities in an exploration and piloting phase, in which awareness raising and the creation of best practices will be key.

Raw materials / Production

Advisory services on urban wastewater treatment and resource recovery



To allow the closing of water loops and the recovery of resources from urban wastewater, a number of changes in current urban sanitation practices are necessary which require advisory services. This includes (amongst others) strategic sanitation planning at city level, the selection of appropriate wastewater treatment technologies, the increase of revenues and cost recovery and the increase of awareness of sanitation service customers. This need offers opportunities for Dutch service providers, though it must be realized that local funding opportunities for these services, either by government or private sector, are still quite limited. Funding may need to be provided by international donors like the ADB, World Bank or UNIDO, by development banks (like FMO) or other sources of funding. The development of Public Private Partnerships and MOUs between Dutch and Vietnamese cities (Amsterdam/Hanoi, Rotterdam/HCMC) may also add value.

Main social economic drivers to request for services on wastewater treatment and recovery of energy and resources will be access to clean water and sanitation and economic development, especially in relation to the bigger cities in Vietnam.

Potential Dutch partners: Companies/organisations providing advisory services like Vitens Evides International, RHDHV, Witteveen+Bos, Deltares, Arcadis, , TU Delft, KWR, Eliquo Water & Energy, etc.

To show what (circular) services Dutch companies and knowledge institutes can offer, participation in the Dutch pavilion at 'Vietwater' (7-9 November 2018) could be explored, in cooperation with NWP. During Vietwater, a seminar will be organised on "Water related challenges - an integrated Dutch approach", including thematic sessions. The opportunities of circular approaches could be presented during one of the thematic sessions.

Consumption

'Water Smart City' consultancy and technical services



The concept of a 'water smart city', either or not as an integral part of a wider 'smart city' concept may offer interesting opportunities for Dutch service providers. Circular elements of the water smart city concept which can be explored/offered include the use of nature based solutions for water catchment (e.g. creation of infiltration capacity, water retention by green roofs. etc.), water storage and water treatment, including the recovery of resources and energy. A baseline assessment of (water) challenges and opportunities on a city level can be a first step. Other services that may be included in a 'Water Smart City' approach include the design, development and construction of climate proof buildings and districts with multifunctional green spaces, infiltration systems, sustainable urban drainage, and rainwater harvesting systems. The use of Public Private Partnerships and MOUs between Dutch and Vietnamese cities may offer opportunities in this respect. A link with the Smart City initiatives already initiated in Vietnam would be a logical step, especially since water management has been identified as a priority issue in several of these initiatives (see the 'Smart Cities' chapter). By 'framing' wastewater treatment and resource recovery as an integral part of a Smart City, new funding opportunities may surface (investments by government and companies in water treatment as such tends to be limited and Dutch technology is relatively costly). Smart City initiatives in which a Dutch-Vietnamese cooperation is already present include Binh Duong, HCMC and Hanoi. At the beginning of 2018, a 'Smart City consortium Netherlands' (SCNL) has been launched in Hanoi (see also the next chapter on Smart Cities).

Services and techniques provided by Dutch businesses could be presented at the Dutch pavilion during the Vietwater fair in November 2018 (in cooperation with NWP).

Main social-economic drivers for these services will be access to clean water, climate adaptation and economic development in the major cities in Vietnam, like Hanoi, HCMC, Danang, Hoi An, Can Tho and Hai Phong. *Potential Dutch partners:* Companies/organisations providing advisory services like WUR, Deltares, RHDHV, Witteveen+Bos, Arcadis, KWR, Eliquo Water & Energy, etc.

Rainwater harvesting, prevention of leakage/water loss, water-efficiency measures and reduction of consumption programs



Although these strategies will be part of a transition towards a circular economy, they are not elaborated here. Dutch companies like Vitens Evides International are already involved in the implementation of opportunities in this area, e.g. in cooperation with Saigon Water Corporation (SAWACO).

Main social-economic drivers for services related to water consumption will be access to clean water and economic development.

Waste management

Septage management services and wastewater purification techniques septic tanks



Specific opportunities may exist with regard to water purification techniques adapted to the use of septic tanks. Septic tanks are widely used in Vietnam and waste water from these tanks is in many cases disposed of without further treatment (except in major cities like Hanoi and HCMC) leading to pollution of groundwater. This offers advisory opportunities with regard to septic tanks and septage management and opportunities regarding additional onsite wastewater treatment techniques, like biofilters or aerobic systems involving artificially forced aeration. External may be required, e.g. through PPPs. Septic management could be presented as an integral part of a smart city or water smart city approach.

Main social economic drivers are access to clean water in urban and rural areas and preventing the growing scarcity of clean water from impacting economic development.

Potential Dutch partners: Companies/organisations providing water purification technology/services like RHDHV, Witteveen+Bos, Arcadis, Vitens Evides, KWR, etc. Organisations involved in Dutch-Vietnamese cooperation: Netherlands Water Partnership, City of Amsterdam and Waternet (MOU Amsterdam-Hanoi), Hogeschool Utrecht (smart sustainable cities initiative), Brainport Eindhoven (Smart cities)

From waste to resources

Wastewater treatment and resource recovery in eco-industrial parks



Opportunities may exist in the provision of techniques for waste water treatment and the recovery of nutrients as part of the (donor funded) development of 'eco-industrial parks' to make existing industrial zones more sustainable. UNIDO has initiated projects in the catchment areas of the two largest rivers in Vietnam, the Mekong River (the (Hoa Khanh industrial zone near Danang, Tra Noc 1&2 near Can Tho) and Red River (the Khanh Phu industrial zone near Ninh Binh). The initiative will run until 2019 and will provide insights in the opportunities for (among others) water treatment and recovery techniques in the industrial zones (IZ). The Vietnam Cleaner Production Centre (VNCPC) is involved in these projects through training and capacity building. The input of Dutch knowledge with regard to circular opportunities in eco-industrial parks and Circular Business Parks (e.g. TNO, Cirkellab) could provide extra value. In case of the presence of Dutch multinationals in these industrial zones, the opportunity of a PPP could be investigated.

Main social economic drivers will be the need to address unsustainable practices for future economic development, access to clean water of communities and the opportunities for innovation and resource efficiency.

Potential Dutch partners: Companies/organisations providing wastewater treatment, resource recovery and circular business park technology/services like TNO, Cirkellab, RHDHV, Witteveen+Bos,

Deltares, Arcadis, Vitens Evides International, KWR, Paques, Eliquo Water & Energy, etc.

Water clean-up, resource recovery and wastewater treatment in major coastal tourist destinations



Although local investments in wastewater treatment are generally very low, the interest in in major tourist destinations for water clean-up solutions for removing solid waste from the water (like plastic) and wastewater treatment technology can be much higher. By recycling the solid waste into commercial products (e.g. plastics into building materials) a business case may be created. For example, to maintain its status as a major tourist destination, pollution in Ha Long Bay needs to be addressed. Solid waste in the water and wastewater from the tourist boats constitute a major problem. The People's Committee of the Quang Ninh Province (the province where Ha Long and Ha Long Bay are located) has expressed its interest in Dutch waste and wastewater treatment expertise. To what extent this interest will be matched with local funding or that other means of (external) funding are needed will need to be explored. Another opportunity may arise when a private water supply company (with a concession agreement with the government) provides water to the public, while generating income by collecting plastic waste in the river. This tackles both water scarcity and waste challenges. Main social-economic drivers for the interest in these services and techniques are economic development in the coastal tourist areas and preservation of the natural environment (enabling ecotourism to flourish). *Potential Dutch partners:* Companies/organisations providing these services and techniques like Upp! UpCycling Plastic, Recycled Park, The Great Bubble Barrier, Deltares, RHDHV, Witteveen+Bos, Arcadis, KWR, Eliquo Water & Energy, etc.

Recovery of energy and resources from industrial wastewater



At this moment, opportunities for technologies that enable energy and resource recovery from wastewater treatment will be limited. However, opportunities may be explored with regard to:

- Frontrunner companies, like Dutch multinationals with strong CSR policies, either or not linked to eco-industrial parks.
- (donor funded) cleaner production programs, like the UNIDO eco-industrial parks programme.
- Sectors which are under pressure from (brands in) export markets and to a growing extent also from local communities, like the textiles sector and leather tanneries.

Main social-economic drivers for the use of resource recovery techniques will be the access to clean water and resource efficiency / economic development.

The link with existing Dutch-Vietnamese cooperation/partnerships (see below) and smart cities can be explored. To limit local investments in recovery technologies, leasing contracts might be considered and small scale solutions (where scale will depend on the type of industry, the size

of the business or the number of households connected to the treatment plant).

Potential Dutch partners:

See '*Wastewater treatment and resource recovery in eco-industrial parks*'

The recently initiated cooperation between The Netherlands and Singapore ('ReCirc Singapore') on circular solutions regarding the treatment of sludge and waste (water) and the recovery of raw materials may serve as a (knowledge) hub for related Dutch initiatives in Vietnam.

7 SMART CITIES

7.1 Characterisation of the sector and challenges

7.1.1 Sector characterisation

Urbanisation in Vietnam

Between 1991 and 2014, Vietnam's official urban population doubled from 14 million to 30 million, and the proportion of the urban population in the total population increased by one-third, with an annual rate of urban population increase well above the global average. Urban areas contribute more than half the gross domestic product (GDP). Vietnam's per capita GDP growth since 1990 has contributed to impressive progress in alleviating poverty and improving non-income dimensions of welfare, as can be illustrated by improvements on some social indicators. (table 4, World Bank Group, Ministry of Planning and Investment of Vietnam, 2016)

Table 4. Improvements in some social indicators (source: World Bank Group, Ministry of Planning and Investment of Vietnam, 2016)

Some number	1993	Ca. 2012
Access to household infrastructure		
Percentage using electricity as main source of lighting	48	98
Percentage with access to an improved water source	67	95
Rural	60	94
Urban	60	90
Percentage with access to clean water		70
Rural	17	61
Urban	60	90
Percentage with access to sanitation facilities	43	75
Rural	36	67
Urban	68	93
Ownership of assets		
Percentage of households with assets		
TV	22	92
Fan	31	88
Refrigerator	4	49
Car	0	1
Motorbike	11	80

However, if land development continues in the business-as-usual approach, Vietnam will face increased congestion, illiquid land markets with increasing housing costs, mass transit needs, stretching out public services and externalities like air pollution and environmental deterioration. (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016)

Smart Cities

The concept of smart cities is about integrating smart initiatives within a variety sectors, including energy, building & environment, education, health and transport, with ICT as the common denominator. Despite its economic achievements, concepts like 'smart cities' are a relatively new

phenomenon in Vietnam and are still in their infant stages. There is a lack of knowledge on the concept of smart cities in the individual sectors and especially about the way in which these issues can be approached in an integrated way. The Vietnamese education system is not adapted to the needs of a growing economy and changing society. (Dutch Ministry of Economic Affairs, 2017)

The need to develop smart urban areas in Vietnam was first put forward 5-6 years ago, but so far no considerable progress has been made. So far, most of the rapidly expanding urban areas are not well planned and designed. In response to the need of 'smarter' cities, the Ministry of Information and Communication has been assigned to develop policies and strategies on smart cities, along with the Ministry of Construction and Ministry of Science and Technology which is in charge of producing a set of criteria for smart cities. The process of urbanization, especially in and around large economic centers, has a central role to play in higher demand for smart cities development in Vietnam. (Dutch Ministry of Economic Affairs, 2017)

In Binh Duong province, Brainport Eindhoven and Becamex IDC Corp have worked together on developing a smart city in the region. The main purpose of a smart city in Binh Duong is to foster the province's socio-economic development to become a pioneer in technological and economic top worldclass region for (high-tech) manufacturing, services and innovation. The model of Triple Helix collaboration (academia/university, industry and government cooperation) is the basis for this strategic program. The Consulate General in HCMC has contributed in organizing two smart city seminars together with Binh Duong People Committee in 2016. A third smart city summit was organised in November 2017. Other projects focusing on the smart city concept include the Thai Nguyen province in the North (creation of a smart urban area together with a South Korean enterprise), Cat Hai Island in Hai Phong (transforming it into smart island, involving a Dutch company, COMA) and Da Nang City (teaming up with Cisco, IBM and Intel to build smart urban areas with e-government). At the beginning of 2018, the Smart City consortium Netherlands (SCNL) was launched during a Smart City seminar that the Dutch Embassy organised with the Ministry of Construction. SCNL includes EIPO/Brainport, RHDHV/NACO, Philips Lighting, NXP, FabMax, GC3S and Hogeschool Utrecht.

In May 2017, a training program on *Smart Sustainable Vietnamese Cities* (SSVC) has been designed and launched in Vietnam, involving the Hogeschool Utrecht (HU). The program, part of the Sustainability Alliance of Urban Networks in Asian Cities (SAUNAC), involves 5 European and 6 Vietnamese Universities. The HU co-organised the launch of the program in May 2017, together with the National University of Civil Engineering (NUCE). The initiative will involve (among others) the creation of an e-learning platform and a regional network on sustainability, including private companies. (SAUNEC, 2017; SAUNEC, 2018)

7.1.2 Challenges

Cities in Vietnam face several challenges, potentially affecting a number of Sustainable Development Goals (SDGs):

Environmental pollution from waste to landfill

As a result of the rapid economic growth in Vietnam there is a steadily increasing volume of Municipal Solid Waste (MSW). Vietnam produces more than 27.8 mil tons/year waste from various sources. The main sources of waste generation are municipal, agricultural and industrial waste. More than 46% (12.8 mil tons/year) are from municipal sources, including households, restaurants, markets, and businesses. The five biggest cities in Vietnam, Hanoi, Ho Chi Minh City (HCMC), Haiphong, Da Nang and Can Tho are the country's hotspots with 70% contribution



to the total waste generation. The MSW composition has a high percentage of biodegradable residues of about 60%–70% by wet weight (Petra Schneider et al, 2017). The most popular means of municipal and non-hazardous industrial solid waste disposal in Vietnam has been burying in landfills or burning. Most of the solid waste is taken to landfills with 91 landfills spread across the country. However, of the 91 landfills, only 17 are hygienic, mostly located in Hanoi or Ho Chi Minh City and constructed using ODA funds. (Thi Thu Hien Le, 2016) The operation of the landfills in function requires improvement in terms of state-of-the-art technologies and leachate management, as well as the closure of the filled landfills. Particular challenges for the landfill closure are the tropic climate with high humidity and large rainfall volumes, leading to an insufficient gas collection system. (Petra Schneider et al, 2017)

Environmental and health hazards through informal waste collection and recycling

The MSW collection rate in HCMC was increased systematically from 73% in the urban area in 1995 (30% rural) to 85% in the urban area in 2015. Collection is done by private (70%) and public institutions (30%). The private institutions include companies and societies of informal waste collectors. (Petra Schneider et al, 2017) On a city level, solid waste is managed by Urban Environment Companies (URENCO), which has full responsibility to collect, transport, and dispose waste generated from the residential areas, industrial parks, hospitals, etc. Hanoi has a higher recycling rate than many other Asian cities with one-fifth of the municipal waste recycled ((Thi Thu Hien Le, 2016). Vietnam has nearly 3000 craft villages which manufacture handicrafts, but also specialize in recycling discarded plastic and other waste materials. The villages buy plastic from local depots or waste pickers and process it into plastic pellets or film that can then be used to make new plastic products such as coat hangers and chairs. More than two-thirds of waste workers are women, who earn less than men working in the waste sector, and 9 percent of waste pickers are children. These groups tend to be socially marginalized. They frequently live on or near garbage disposal sites, and thus are exposed to environmental and safety hazards. (Global alliance of waste pickers, 2018)



The demand for efficient waste management solutions and waste treatments in Vietnam is high. Many projects have been started recently in response to the growth of waste generation. For example, between the year 2013- 2015 in Hanoi, 12 municipal waste disposal facilities and landfills were started with the funding from state-owned institutions. Local waste management companies are 37 constantly looking for waste disposal technologies from abroad. Most of the technology providers are from Singapore, China, USA, and European countries (Thi Thu Hien Le, 2016).

Congestion and fuel consumption in transport

Fossil fuel consumption has been increasing in transport. Motorcycles have seen the fastest rise over a decade, dominating growth in vehicle ownership. In Hanoi, public transportation provides only about 7

percent of passenger trips, and in Ho Chi Minh City around 5 percent. The largest share of motorcycles nationwide is in cities, with 15 percent in Ho Chi Minh City and 8.5 percent in Hanoi in 2010 (MONRE and MOT 2012) (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016). The congestion and use of motorcycles in cities has growing implications for the air quality and resulting health risks (see also below).



Health hazards from air and water pollution

Urban wastewater is the largest contributor to water pollution in many parts of the country. Sanitation and wastewater collection and treatment will be critical for improving water quality. A small share of urban wastewater is treated (10 percent), and an even smaller share (4 percent) of septage (septic tank sludge) is safely disposed. The growth of fossil fuel energy consumption by industry and coal-fired power plants in northern Vietnam is increasing air pollution. Satellite images show high levels of average fine particulate matter (PM2.5) around Hanoi, approaching levels in China and several times higher than safe levels recommended by the World Health Organization. (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016)



Most urban populations have better access to care and health outcomes than rural communities. However, the urban poor face health risks the rural poor do not, including those related to air quality, road traffic safety, water, sanitation, and solid waste management, in addition to infectious diseases such as dengue and tuberculosis. The major policy challenge facing Vietnam’s health system over the next 20 years is to ensure that everyone has access to good quality services without suffering financial hardship. (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016)

Data on air pollution, emissions levels, and source structures are scarce. Some transportation data exist, but few data are available for other sectors. Understanding is also lacking on how much some sectors contribute to urban air pollution. This information gap must be plugged to understand PM2.5 formation and its impact—and to augment the environmental and economic effects that have focused on total suspended particles and PM10. (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016)

Urban-rural gaps in incomes and access to infrastructure

Although the urban–rural gaps in incomes and access to infrastructure and social services have narrowed, the urban–rural connectivity remains weak and fragmented. Migrants to urban areas receive lower wages and have less access to urban services. Without permanent residence under the household registration system, migrants face difficulties in daily aspects of urban living, such as applying for a job, trying to get a loan, registering a business (or motorbike), buying or renting a house, and signing up for medical insurance. (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016)



Gender

Vietnam has achieved impressive outcomes on gender equality. Gender differences in school enrolment and attainment are minimal, and the gender wage gap is modest. However, women remain outliers in private- and public-sector leadership positions. (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016)



Risk of flooding through climate change

Climate change is expected to result in increased tropical cyclone intensity, sea-level rise, and coastal flooding. These are projected to affect coastal cities, where increasingly large populations and assets are exposed to climate change risks. High urban growth rates, combined with inadequate urban housing, lead to expanding informal settlements. Ho Chi Minh City is expected to be particularly exposed. (World Bank Group, Ministry of Planning and Investment of Vietnam, 2016)



Figure 17 & 18. Informal waste recycling in a craft village (photo right: Closing the Loop)

Policy and regulation

Key policies and regulations to build on and take into account with regard to circular economy initiatives in smart cities:

- In 2012, the Vietnamese Government officially approved the Vietnam National Green Growth Strategy (VNGGS) for the period 2011 - 2020, vision to 2050. The strategy is structured around 3 strategic tasks:
 1. Reducing greenhouse gas emissions and promoting the use of clean and renewable energy.
 2. Greening the production based on:
 - Implementation of a clean industrialization strategy via adjusting sector master plans;
 - Development of green industry, agriculture, technologies and equipment;
 - Investment in natural capital;
 - Prevention and treatment of pollution
 3. Greening lifestyle where traditional lifestyle is combined with the means to create quality and traditionally rooted living standards, including the creation of green jobs.
- The recycling targets of the 'National Waste Management Strategy' provide a framework for a circular economy in Vietnam, focusing on a complete waste collection by 2025.

- Institutional arrangement of solid waste management in Vietnam is complex and involves many Ministries in the system. Some main legal documents on solid waste management (Thi Thu Hien Le, 2016):
 - Law 55/2014/QH13 dated 23/6/2014 on Environmental Protection
 - Decree No.59/2007/ND-CP dated 09/04/2007 on solid waste management
 - Decree No.174/2007/ND-CP dated 29/11/2007 on environmental protection fee of solid waste
 - Decree No.04/2009/ND-CP dated 14/1/2009 on Government's incentives and supports on environmental protection activities
 - Circular No.121/2008/TT-BTC dated 12/12/2008 on financial supports for investment in solid waste management sector
 - Decree No.117/2009/ND-CP dated 31/12/2009 on guidance on executing violations in environmental protection sector
 - Decree No.69/2008/ND-CP dated 30/5/2008 on incentives for educational, healthcare, cultural, vocational, sports and environmental activities
- Policy and regulation on renewable energy: see section on Renewable energy
- Policy and regulation on water management: see section on Water management

7.2 Circular economy opportunities

Circular strategies related to smart cities can be defined as strategies that use data and the internet of things (IoT) in such a way that circular practices in the city are enhanced. An example of this is the use of online marketplaces for the sharing of products and the use of smart lighting reducing energy use. However, in this case a broader definition will be used, also including circular solutions in a city which do not necessarily rely on data or the IoT. In this way, circular strategies like circular building and recycling of waste are also covered. These strategies can also benefit from the focus on smart cities in Vietnam. Part of the circular opportunities in cities have already been covered in other sections of this scoping study, i.e., water management and renewable energy. These topics will not be repeated here, but will be referred to.

The table in annex 3 provides a general overview of CE-strategies related to (smart) cities, focusing on the built environment in a city (circular building and building materials), energy systems (smart lighting, renewable energy), the urban mobility system (multi modal transport, electric cars), the urban bio-economy (food waste and nutrient cycles) and production systems (circular design, repair, product sharing, urban mining, recycling). Each of these areas may offer business opportunities for Dutch businesses and organisations. During the launch of the Binh Duong smart city initiative in 2016, the following areas of interest were identified (Becamex, EIPO, 2016):

- Lighting
- Utilities
- Waste management
- Water management
- Traffic Management
- Public safety

Similar topics for smart city action were identified for HCMC, Dan Nang and Hoi An in the 'Smart City Innovation Challenge' (2017) which was organised in Vietnam by Mekong Business Initiative, Asian Development Bank, Australian Government and TNB Ventures (see figure 19).



Figure 19. Key areas of focus from the ‘Smart City Innovation Challenge 2017

Examples of smart innovations for these areas of interest are included in annex 4.

The following opportunities were identified that have the potential to enhance the circularity of cities and to contribute to the SDGs currently at stake:



Figure 20. Circular business opportunities in smart cities in Vietnam

The opportunities are explained below, including the social-economic challenges/SDGs which may serve as a driver to take action:

Raw materials

Circular city baseline assessments and cooperation



The concept of sustainable or circular smart cities is still quite new to Vietnam. Opportunities exist for Dutch companies and organisations to conduct Circular city baseline assessments providing a systematic overview of circular opportunities in the (smart) city. Examples in the Netherlands include the assessment conducted for the city of Amsterdam and the 'City Deal Circulaire Stad', a cooperation between 8 Dutch municipalities on circular economy.

Potential Dutch partners: Companies/organisations providing services on circular cities, like: Circle Economy, TNO, Fabric, Royal HaskoningDHV, Arcadis, etc. Organisations involved in Dutch-Vietnamese cooperation: Organisations and companies in the Smart City Consortium Netherlands (SCNL), City of Amsterdam (MOU Amsterdam-Hanoi), AEB (MOU Amsterdam-Hanoi), Hogeschool Utrecht (smart sustainable cities initiative), Brainport Eindhoven (Smart cities).

Production

Circular building concepts and materials



Opportunities exist in modular building, smart construction techniques and flexible design to facilitate easy maintenance and re-use and recycling of building components and materials and to facilitate the design of multi-purpose buildings. Moreover, the production of recyclable building materials and building materials with recycled content will enable material loops to be closed. An example of the latter are the building materials produced and traded by Upp! UpCycling Plastic. Smart city linkages include the systematic use of data on material use ('building passports') and online marketplaces for secondary materials.

Potential Dutch partners: Companies/organisations providing sustainable/circular building solutions, like: Upp! UpCycling Plastic, TU Delft, VolkerWessels, Heymans, TNO, Royal HaskoningDHV, Arcadis, etc. Organisations involved in Dutch-Vietnamese cooperation: see 'Circular city baseline assessments and cooperation'.

Urban farming



See 'Urban farming' in the chapter on 'Agriculture'.

Consumption

Smart lighting solutions



By using software solutions and LED lighting in the lighting of cities, energy use can be reduced, maintenance of lighting systems can be improved and the feeling of safety can be enhanced. Moreover, lighting systems may also be used to collect data on (for example) air quality. Extended producer responsibility, e.g. by means of selling light instead of lamps, can also enhance the energy efficiency and circularity of the lighting systems applied. In Vietnam, Philips is already involved in the smart cities project with Brainport Eindhoven.

Potential Dutch partners: Providers of smart lighting solutions, like Philips and members of the IGOV Innovation Platform (Innovatie Platform Openbare Verlichting). Organisations involved in Dutch-Vietnamese cooperation: see 'Circular city baseline assessments and cooperation'.

Smart logistics, Fuel efficient and electric mobility, Sharing platforms



Opportunities exist with regard to smart logistics solutions in cities, including scenario analysis of logistics and sustainable solutions, using digital maps, traffic flows and demographic data, applications facilitating the use of public transport, sharing platforms for car sharing (see chapter on 'Logistics') and fuel efficient/electric mobility (see chapter on 'Logistics').

Potential Dutch partners: Providers of products, services and technology on smart logistics, like TNO, TU Eindhoven, the Smart Logistics Hub, City Hub, etc. See also the chapter on Logistics.

Sharing platforms



See 'Sharing Platforms' in the chapter on 'Logistics'.

Waste management

Inclusive and environmentally sound waste processing and recycling



There is a clear demand in Vietnam for efficient waste management solutions and waste treatment. Changing the situation of a large informal sector and craft villages involved in waste collection and recycling requires inclusive solutions, involving the people that currently depend on this work and income. Several companies and organisations in the Netherlands have experience in this field. Although the link with e-government thinking, data and IOT is not as strong as with smart lighting or smart logistics, the Binh Duong smart city initiative and the Smart City Innovation Challenge 2017 (focusing on HCMC, Da Nang and Hoi An) show that waste management is considered a priority in a smart city. *Potential Dutch partners: Companies/organisations providing waste collection and waste processing know-how and technology, like WASTE, Closing the Loop, AEB, SUEZ.* Organisations involved in Dutch-Vietnamese cooperation: see 'Circular city baseline assessments and cooperation'.

From waste to resources

Closing water loops, waste water treatment and nutrient recovery in the urban environment



See 'Water management' and the Water Smart City opportunities mentioned. Water management was also identified as a priority in the smart city initiatives mentioned before.

Urban mining concepts and technologies



Cities hold many a lot of materials that can be reused and doing so can address over-exploitation of scarce natural resources. Urban mining makes clever use of the materials that are already there, reducing the need to extract new materials and reducing the amount of waste. For example, the increasing amount of electronics, such as consumer products and green technologies, increases the demand of critical metals such as indium and gallium. Scarcity and a growing demand have triggered technological solutions to recover valuable materials from products, building constructions and waste. Opportunities lie in selling Dutch expertise, urban mining approaches and technologies linked to smart city approaches.

Potential Dutch partners: Companies/organisations providing urban mining know-how and technology, like WASTE, Closing the Loop, Metabolic, AEB, SUEZ.

8 ROADMAP

8.1 Introduction

To benefit from the opportunities the transition towards a circular economy could offer in Vietnam, a roadmap is designed, consisting of a number of short term and mid to long term actions. These actions are based on the information gathered in the scoping study and the interest that Dutch and Vietnamese stakeholders have expressed during the interviews, the scoping mission, the meeting of Dutch businesses in December 2017 (annex 2), the presentation of the interim results in February 2018 in Vietnam and during contacts following this presentation. For each action, potential partners involved are identified, as well as support and instruments by the Dutch government that could support the action.

It should be noted that this road map is not a fixed overview of next steps, but a recommendation based on the scoping study. Different organisations and companies have shown interested in a follow-up and these follow-up steps may also be taken independently from this road map.

The roadmap is based on a number of key findings:

- Vietnam's Green growth strategy, its environmental policies and objectives and its social-economic challenges offer many openings to circular solutions, both in the public domain (cities) and the private domain (companies).
- The knowledge of the concept of circular economy at government level, in the public sector and the private sector is still quite limited in Vietnam, with some exceptions, like the Central Institute for Economic Management (CIEM), the Vietnam Chamber of Commerce and Industry (VCCI), the Vietnam Cleaner production Centre (VNCPC) and multinational enterprises that are active in the field of corporate social responsibility, like Heineken, Dow, Unilever and Friesland Campina.
- There is still a lot to win in Vietnam where it comes to resource efficiency and basic environmental management. Building capacity on circular approaches will allow government and business to think beyond eco-efficiency and take a value chain approach right from the start (also taking into account reuse, remanufacturing and recycling options).
- The fact that knowledge on a circular economy is still limited means that awareness raising and capacity building on circular approaches will be necessary to show its potential value, to trigger interest and to create the skills with public and private actors to develop and implement circular economy policies, strategies and actions.
- Creating business best practices will be necessary to illustrate the (business and societal) value of circular strategies and trigger interest.
- Local funding opportunities for circular economy programs, projects and actions are expected to be limited at this stage, with the possible exception of funding by multinationals as part of their (corporate) CSR strategy. This means that external funding may be necessary to work on capacity building and best practices.

8.2 Road map actions

To enhance the opportunities for Dutch business to contribute to a circular economy in Vietnam, actions in the areas of policy development, the public sector, the private sector and education/knowledge (triple helix) will be necessary. These actions can be divided in short term actions (within 1-2 years) and mid-term actions (within 2-3 years). A summary of actions is included in the table below (including focus, planning and related instruments and support), followed by a brief explanation of each action.

Table 5. Road map actions, including focus (policy, government, business, knowledge), planning (short or mid-term) and need for government support

Actions	Focus (*)				Planning (**)		Instruments/support
	P	G	B	K	1	2	
Facilitate matchmaking							
Explore opportunities Dutch CE consortium Plastics & Renewable Energy		○	○				Support RVO and Embassy through Impact Cluster support
Circular economy missions to Vietnam (e.g. participation Vietwater)			○		○		Mission support RVO and Embassy Support NL International Business Impact Cluster support
Create an online CE Matchmaking community		○	○	○		○	RVO/Embassy financial support Impact Cluster support
CE partnership in Singapore as a circular hub to Vietnam			○			○	Contacts RVO
Create best practices							
Cooperate with UNIDO on circular projects with Dutch multinationals			○		○		Proposal has been submitted with EC
Integrate CE in cleaner production practices in Vietnam			○	○		○	Nuffic OKP TMT program
Build on existing Dutch – Vietnamese cooperation / participation		○	○	○	○		Contacts and introductions Embassy
Build on the interest for Smart city initiatives		○	○	○	○		Contacts and introductions Embassy Impact Cluster support
Build on clear business cases for circular economy in Vietnam		○	○		○		Contacts and introductions Embassy Mission support Support NL International Business

Actions	Focus (*)				Planning (**)		Instruments/support
	P	G	B	K	1	2	
Capacity building educational/knowledge institutes and sector associations							
Participate in Centre of Excellence CE of VCCI			○	○	○		Contacts and introductions Embassy Impact Cluster support
Build capacity with VNCPC and other knowledge institutes				○	○		Contacts and introductions Embassy Nuffic OKP TMT program K2K support
Policy development							
Provide knowledge to integrate Circular economy in the national Green growth strategy	○	○				○	G2G support
Exchange experiences on CE in cities	○	○				○	G2G support to enable city exchange/missions

(*): Policy (P), Government (G), Business (B), Knowledge (K)

(**): 1 (short term, 1-2 years), 2 (mid-term, 2-3 years)

Facilitate Dutch – Vietnamese matchmaking

Explore opportunities Dutch Circular economy consortium (short term)

The scoping study and follow-up discussions with stakeholders active in Vietnam shows that the opportunities of a Dutch Circular economy consortium could be explored. The focus of this consortium could be on Sustainable Urban Development, Plastics and/or Renewable Energy (preliminary selection of topics). Such a consortium should combine complementary expertise and enable 'one stop shop' solutions. The consortium can also serve as a serious discussion partner for Vietnamese government and organisations like VCCI. The exact focus and framing of this consortium (e.g. CE as a part of sustainable urban development) will need to be explored.

- Potential partners (based on a focus including Plastics): Dutch businesses active in or interested in CE-related business in Vietnam, including Upp! UpCycling Plastic, QCP Quality Circular Polymers, Black Bear, ING and supporting organisations like NL International Business, Acceleratio, Brainport Eindhoven, Partners for Innovation, CREM
- Supporting instruments: Impact Cluster Funding and support, support NL International Business'

Circular economy missions to Vietnam (short term)

The Trade Mission to Vietnam of 5-7th of February 2018, with Minister for Foreign Trade and Development Cooperation was organised with the goal to further strengthen the economic and political relations with Vietnam. During this Trade Mission matchmaking was facilitated for the 45 participating companies. A comparable mission on circular economy could be organised in close cooperation with NL International Business, bringing Dutch businesses and knowledge institutes to Vietnam for matchmaking purposes. The results of the scoping study and the contacts from the scoping mission can be used as an input for such a mission. Several of these

missions have been and are still being organised by Holland Circular Hotspot and RVO. Vietnam is currently not on the country list of Holland Circular Hotspot, but the options to add Vietnam to this list can of course be explored (e.g. as part of the 45 year relation between the Netherlands and Vietnam).

A specific opportunity in the area of water management is the Vietwater fair in November 2018, where, in cooperation with NWP, circular services and techniques could be presented at the Dutch pavilion and during a thematic session.

- Potential partners: NL International Business, RVO, Holland Circular Hotspot, ING (Remco Gaanderse), Acceleratio (Freek van Eijk), CREM, Partners for Innovation, VCCI, other Vietnamese organisations and businesses visited during the scoping mission
- Supporting instruments: Mission support RVO and Embassy, Support NL International Business, Impact Cluster support

Create an online CE Matchmaking community (short term)

'Nederland Circulair', a cooperation between a number of Dutch organisations working on circular economy and supported by the Ministry of Infrastructure and Water, has created the matchmaking website www.circulairondernemen.nl. This website brings challenges and solutions together in the field of circular economy. Such a matchmaking website could also be developed for Dutch-Vietnamese cooperation on circular economy: Circularbusiness NL-VN. To make this into a successful platform for the exchange of challenges and solutions between Dutch and Vietnamese businesses and organisations, the use of this platform will need to be promoted and facilitated. Again a link with the 45 year relation between the Netherlands and Vietnam could be made through use of the 45 year-logo and by matching 45 challenges and solutions. As a first step, the platform could be linked to the existing strategic partnerships on smart cities and the (potential) CE consortium on plastics and renewable energy.

- Potential partners: MVO Nederland, Holland Circular Hotspot, NL International Business, CREM, Partners for Innovation, VCCI, VNCPC
- Supporting instruments: RVO/Embassy financial support, Impact Cluster support

CE partnership in Singapore as a circular hub to Vietnam (mid-term)

Explore the opportunities of using the PIB Cluster 'ReCirc Singapore' as a circular hub to Vietnam. Some of the companies involved in ReCirc Singapore are also active in Vietnam, like Paques, and Upp! UpCycling Plastic. The experience with circular initiatives within ReCirc Singapore may offer new opportunities for circular initiatives in Vietnam. If focused around a specific circular strategy (like resource recovery in the ReCirc initiative), a similar initiative could also be initiated in Vietnam.

- Potential partners: Depends on the focus of the initiative: companies and organisations involved in ReCirc, VNCPC
- Supporting instruments: contacts RVO

Create best practices

Cooperate with UNIDO on circular projects with Dutch multinationals (short term)

UNIDO has expressed its interest to work with Dutch multinational companies located in Vietnam on circular economy projects. During the Dutch mission in February 2018 first contacts were made by UNIDO with Unilever, Philips and Friesland Campina. A cooperation with UNIDO on these projects may result in a public private partnership creating a first set of best practices which can be used in communication on circular economy.

- Potential partners: UNIDO, Unilever, Philips, Friesland Campina, Dutch Sustainable Growth Coalition (DSGC), Holland Circular Hotspot, VCCI, VNCPC
- Supporting instruments: A proposal has been submitted with the European Commission.

Integrate CE in cleaner production practices in Vietnam (mid-term)

Vietnam Cleaner Production Centre (VNCPC) is a non-profit organisation that supports Vietnamese SME's with both scientific and technological services on Resource Efficient and Cleaner Production, as well as Climate Change Adaptation. Cooperation with Holland Circular Hotspot and the CIRCO project is a possibility to integrate the knowledge and tools of the Dutch CIRCO project in the portfolio of VNCPC, thereby enabling VNCPC to contribute to the creation of best circular best practices in Vietnam. ²

- Potential partners: Holland Circular Hotspot, CIRCO, CIRCO trainers, VNCPC, Vietnamese sector associations, like the Vietnam Electronic Industries Association (VEIA, focus on e-waste).
- Supporting instruments: Nuffic OKP TMT program, K2K support

Build on existing Dutch – Vietnamese cooperation / participation (short term)

The Netherlands and Vietnam are already cooperating in a number of strategic partnerships and MOUs (including partner cities), e.g. on agriculture, water/Delta management and city partnerships between Amsterdam and Hanoi and Rotterdam-HCMC. By linking the circular economy opportunities in these sectors to the existing cooperation, already existing examples of circular initiatives may surface and new opportunities may be identified.

- Potential partners: Dutch and Vietnamese Partners of existing partnerships and MOUs, Dutch experts Circular economy
- Supporting instruments: Contacts and introductions Embassy

Build on the interest for Smart city initiatives (short term)

Circular economy is a new, innovative concept which links quite well with the innovative concept of smart cities. There is a lot of interest in Vietnam in the concept of smart cities and circular solutions like smart lighting and smart logistics may be able to profit from this trend. A smart city can only be smart and future proof if it is a sustainable smart city. This concept is already being introduced by Brainport Eindhoven and is the focus of the SAUNEC initiative (involving the Hogeschool Utrecht). The opportunities of linking circular economy opportunities to these and other sustainable smart city initiatives in Vietnam can be further explored, e.g. as an input to a circular economy mission to Vietnam or a mission by Vietnamese city representatives to the Netherlands (e.g. In cooperation with the Association of Cities in Vietnam: ACVN). The Dutch experience of conducting circular city baseline assessments could constitute a key first service for export.

- Potential partners: Brainport Eindhoven, Circle Economy, TNO, Hogeschool Utrecht, NUCE, BECAMEX, ACVN.
- Supporting instruments: Contacts and introductions Embassy, Impact Cluster support

Build on clear business cases for circular economy in Vietnam (short term)

Circular strategies can offer a solution in regions where environmental and socio-economic challenges require short term action from a business perspective. An example identified during the scoping study is the situation in Ha Long Bay in Quang Ninh Province, where the pollution of the bay is threatening tourism, a major source of income in this tourist destination. The need

² CIRCO is a Dutch government funded program by the Dutch organisation 'CLICKNL', carried out by a number of Dutch organisations focusing on the transition towards a circular economy. CIRCO provides training and a community to share experiences.

and clear business case to act on these challenges may offer extra opportunities for bringing in circular solutions.

- Potential partners: Waste management and processing expertise, like AEB, VNCPC
- Supporting instruments: Contacts and introductions Embassy, Mission support, Support NL International Business

Capacity building education/knowledge institutes and business associations

Participate in the Programme /Centre of Excellence on Circular Economy of VCCI (short term)

In January 2018, VCCI has launched a programme on circular economy. A memorandum of understanding was signed between VCCI's Vietnam Business Council for Sustainable Development and Unilever Vietnam, Coca Cola Vietnam and Dow Chemicals to work on a 'Zero Waste to Nature' initiative. The programme has the following goals: including solving problems arising from plastic waste, developing a roadmap for promoting sustainable business models, developing circular-economy oriented value chains and raising policy recommendations for advancing circular economy (VCCI website, 2018). During the scoping mission, VCCI already expressed its interest in cooperating with Dutch knowledge institutes and Dutch multinationals like Heineken and Philips in a Centre of Excellence on Circular Economy. VCCI already has contacts with these businesses through the Vietnam Business Council for Sustainable Development and the Global Compact.

- Potential partners: Circular economy experts in the Netherlands, VCCI/VBCSD, UNIDO, Dutch businesses already active in Vietnam with an interest in or already working on circular strategies.
- Supporting instruments: Contacts and introductions Embassy, Impact Cluster support

Build capacity with VNCPC and other knowledge institutes (short term)

Knowledge of the concept of a circular economy and circular strategies is still quite limited in Vietnam. Organisations like the Vietnam Cleaner production Centre (VNCPC) is already familiar with the concept and could be supported further by providing Train the Trainer support. The VNCPC in its turn can train companies on circular strategies. A similar approach can be taken in respect to other knowledge and educational institutes, like NUCE. Involvement of Dutch universities already active in Vietnam (like Hogeschool Utrecht) would be a logical step.

- Potential partners: Dutch educational institutes, like Hogeschool Utrecht and consultancies providing training, CIRCO, VNCPC, NUCE
- Supporting instruments: Contacts and introductions Embassy, Nuffic OKP TMT program, K2K support

Policy development

Provide services to integrate Circular economy in the national Green growth strategy (mid-term)

The Vietnamese Green Growth strategy offers a good framework to position circular economy as one of the strategies to contribute to the objectives the Vietnamese government has formulated. One of the opportunities is to share knowledge on the macro-economic analysis that have been conducted on circular economy in the Netherlands, like the study 'Opportunities for a circular economy in the Netherlands' (TNO, 2013). The 45 year relation between the Netherlands and Vietnam can offer an interesting basis for cooperation between governments on this topic.

- Potential partners: Dutch government (Foreign Affairs, Economic Affairs and Climate, Infrastructure and Water), Vietnamese government (e.g. CIEM), VCCI, TNO, other Dutch experts on circular economy
- Supporting instruments: G2G support

Exchange of experiences on CE in cities (mid-term)

A growing number of Dutch cities has developed circular economy objectives and strategies on a city level. By sharing this experience with Vietnamese cities, e.g. through city missions, the market for Dutch circular services and techniques can be expanded. The Association of Cities in Vietnam (ACVN) has already expressed its interest in such an exchange on policy level.

- Potential partners: Dutch cities, VNG, Cirkelstad initiative, service providers involved, ACVN.
- Supporting instruments: G2G support to enable city exchange/missions

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ANNEX 1 ORGANISATIONS AND BUSINESS IN THE SCOPING MISSION

The following organisations and businesses were contacted during the scoping mission, either by means of a visit in Vietnam, or by telephone:

Government

- Vietnam Inland Waterway Administration (VIWA)
- Ministry of Planning and Investment, Central Institute for Economic Management (CIEM)
- Ministry of Industry and Trade, Department of Renewable Energy
- Peoples Committee of Quang Ninh
- URENCO

Business

- Vietnam Chamber of Commerce and Industry (VCCI)
- Vietnam Association of Seafood Exporters and Producers (VASEP)
- Vietnam Electronic Industries Association (VEIA)
- Association of Cities of Vietnam (ACVN)
- EuroCham, Green Growth Committee
- Dutch Business Association Vietnam (DBAV)
- Royal HaskoningDHV
- Fresh Studio
- Heineken
- Friesland Campina
- Boskalis
- Damen
- Da Lat Hasfarm
- Climate Sense Vietnam
- ING Nederland (R. Gaanderse, former ING Vietnam)

Knowledge institute

- National University of Civil Engineering (NUCE)
- Vietnam Cleaner Production Centre (VNCPC)
- Foreign Trade University

NGO

- Green Innovation and Development Centre (GreenID)
- SNV Vietnam

International organizations

- United Nations Industrial Development Organisation (UNIDO)
- World Bank

Individual experts

- Mrs. Pham Chi Lan, Independent Economic Researcher

ANNEX 2 MEETING ‘VIETNAM IN THE SPOTLIGHT’

EvoFenedex has organized a meeting on 7th of December in the Netherlands with Dutch organisations and businesses that are potentially interested in contributing to circular economy initiatives in Vietnam. The goal of this interactive meeting was to inform the companies of the results of the scoping study, to test the findings, to conduct a SWOT analysis with the participants and to identify follow-up steps.

The meeting was attended by 25 people from different organizations and companies. A summary of the SWOT is presented in the matrix below:

Strengths Dutch partners <ul style="list-style-type: none"> • Knowledge and solutions on sustainability and circular economy • International orientation • Trade agreement 	Weaknesses Dutch partners <ul style="list-style-type: none"> • High price level compared to local competition • Network and understanding of local Vietnamese situation and market
Opportunities Vietnam <ul style="list-style-type: none"> • Fast growing economy • Young population (good education, basic knowledge available, eager to learn and hardworking) • Friendly people, open culture (always on time and deal=deal) • Cooperation SMEs NL & VN • Building activities (sustainable building, energy labels, climate control) • Agriculture sector (turn-key projects, horticulture, fertilizers and biobased opportunities) • Cattle breeding (milking robots and scaling, mega farms) • Renewable Energy (wind and solar) • Foreign Direct Investment (FDI) to private sector in Vietnam (not only focus on public sector) 	Threats Vietnam <ul style="list-style-type: none"> • Export and import licenses • Bureaucracy (paperwork and contracts) > always be compliant! • Patience is necessary (registration of products, such as fertilizers) • Hierarchy is important (respect for older people) • English is sometimes a problem (especially older and rural people) • Corruption (customs) • Infrastructure is a challenge • Property of land is not possible (only leasing and renting) • In- and outgoing money flows is difficult

Tips and tricks:

- A good local partner (distributor or licensee) is essential (not everybody is reliable).
- Import formalities done by local partner.
- Always be compliant, otherwise big risk and much delay!
- Building trust and relationship.
- Selling knowledge is part of the deal.
- Good information on government rules.
- Adaptation to local market and business climate (note: big cultural differences between North and South Vietnam).
- Local entity in Vietnam is only possible after min. 1 year operation (plus min. 200K capital).

ANNEX 3 CIRCULAR STRATEGIES IN CITIES

The table below provides an overview of circular strategies in a (smart) city.

Table A1 Circular economy strategies in (smart) cities (adapted from ‘Cities in the circular economy: an initial exploration’, Ellen MacArthur Foundation, 2017)

Topic	CE-strategies	Explanation
The built environment	Modular and flexible design	<ul style="list-style-type: none"> • Modular building and smart construction techniques facilitate easy maintenance and re-use and recycling of building components and materials. • Flexible design creates opportunities of changing the purpose/use of a building during use (sharing) and after use (expanding the lifespan of the building)
	Material use	<ul style="list-style-type: none"> • Use of recycled materials instead of virgin materials • Use of recyclable materials to enable recycling • Use of (sustainably produced) renewable materials instead of non-renewable materials • Use of healthy materials
	Energy production instead of energy use	<ul style="list-style-type: none"> • Buildings are designed to save energy (design, insulation) and to produce energy (solar energy).
	Closed loops for water and nutrients	<ul style="list-style-type: none"> • The building enables recycling and re-use of water and nutrients (e.g. from food waste).
Energy systems	Use of renewable energy, including solar, wind and thermal energy	<ul style="list-style-type: none"> • A shift from fossil based energy systems to renewable energy • Reuse of excess heat • Use of heat pumps
	High quality distribution and energy storage	<ul style="list-style-type: none"> • Smart grid • Thermal energy storage
	Efficient and effective energy use	<ul style="list-style-type: none"> • Energy efficient technologies
Urban mobility system	Accessible, affordable and effective multi modal mobility structure of low impact transportation	<ul style="list-style-type: none"> • Multi modal mobility structure including public transportation and on demand cars • Electric powered cars, shared and automated • Vehicle design focuses on remanufacturing, durability, efficiency and easy maintenance
The urban bio-economy	Minimisation of food waste and	<ul style="list-style-type: none"> • Minimisation of food waste

	creating nutrients cycles	<ul style="list-style-type: none"> • Recovery of nutrients from the organic waste fraction of municipal solid waste and wastewater streams • Production of organic fertiliser for urban and rural agriculture • Urban farming enabling local production and closed, local loops • Generation of electricity from wastewater, biofuels and biorefineries
Production systems	Creation of local value loops (**)	<ul style="list-style-type: none"> • Circular design • Product-service systems • More local production • Repair shops • Collective resource banks evening out demand and supply of materials • Digital application to broker the exchange of goods, materials and services (including product sharing and re-use of products) • Urban mining: recovery of valuable materials from discarded products and waste • Recycling

ANNEX 4 SMART CITY INNOVATION CHALLENGE: EXAMPLES OF INNOVATIONS

Examples of smart city innovations, included in the briefing of the ‘Smart City Innovation Challenge’ (Mekong Business Initiative, Asian Development Bank, Australian Government, TNB Ventures, Smart City Innovation Challenge 2017):

- *Energy efficiency – Affordable housing*
Urban city planning for efficient housing infrastructure, solutions bringing down the cost of living through smarter power/energy usage, e.g. smart electricity meters to monitor usage of utilities.
- *Traffic management & smarter parking*
Smart traffic management, like sensors and cameras helping to collect real-time information about traffic density, smarter systems for finding parking lots and toll collections.
- *Drainage, sewerage and waste management*
Harnessing sensor data to be used in the management of waste treatment.
- *Urban agriculture*
IoT farming, Creating an agricultural product market for the tourism industry (in addition to providing local residents with sufficient agricultural resources, hi-tech agricultural production is also expected to enhance the development of the tourism industry), Hydroponics or vertical farming
- *Green areas and public spaces*
Software to manage the ideal green areas in a city planning context
- *Water purification and water delivery*
Solutions addressing the expected future demand with the rapid urbanization rate.
- *E-government services*
Improve hotline services so citizens can submit feedback and enquire more efficiently, Use of video-conferencing to reach rural areas.
- *Providing public security and monitoring of natural disasters*
Video surveillance, data-driven disaster response units and emergency services unit
- *Ecotourism*
Technologies or projects suited for the environment conservation/“save the earth” concept
- *Environmental planning for the city*
Processes that provide the basis for decision making with regards to land development, taking into consideration the environmental, social, political, economic and natural factors. It provides a comprehensive framework for achieving sustainable results.
- *Healthcare*
IoT-aware, smart architecture for automatic monitoring and tracking of patients, personnel and biomedical devices within hospitals and medical institutes; Solutions that might prevent further widespread of rampant disease/influenza within the country.
- *Education*
More student-centered approaches to learning that is intrinsically motivating; Implementing online learning or mobile learning systems; Smart Campus solutions to enhance the learning experience at school.

ANNEX 5 FACTSHEET CIRCULAR ECONOMY IN VIETNAM

The factsheet 'Circular economy in Vietnam' on the next few pages can also be acquired from RVO and the Dutch Embassy in Hanoi.



Netherlands Enterprise Agency

Circular economy in Vietnam

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Circular Economy in Vietnam

Vietnam's per capita GDP growth since 1990 has been among the fastest in the world. A growth which has contributed to impressive progress in alleviating poverty and improving non-income dimensions of welfare. However, this growth has also generated challenges with regard to environmental degradation. The environmental quality of Vietnam's air, land, and water has deteriorated considerably. Moreover, Vietnam is one of the world's most vulnerable countries to climate change, with adaptation challenges accordingly severe, especially in the Mekong Delta. Despite of a relatively high rate of (informal) solid urban waste recycling, the current economy leads to the depletion of precious resources and does not account for negative externalities exerted upon the environment.

The circular economy presents a sustainable solution to this linear economic model. Although circular economy thinking is still quite new to Vietnam, the National action plan on Green growth includes many actions that fit perfectly with the transition towards a circular economy and the Vietnam Chamber of Commerce and Industry (VCCI) is considering the establishment of a Centre of Excellence on Circular economy.

The Netherlands is a Circular Hotspot with a wealth of knowledge and experience on circular economy. Dutch businesses could play a valuable role in accelerating the circular economy (CE) in Vietnam. A scoping study was conducted at the end of 2017 to identify potential areas of circular (business) cooperation.

This factsheet addresses CE related opportunities for Dutch businesses in the following sectors:

- Agriculture
- Renewable Energy
- Logistics
- Water management
- Smart cities

Agriculture

Currently, agriculture accounts for almost 20% of the national GDP. Decentralized, smallholder agricultural production is the norm. Vietnam is one of the world's top

exporters of agricultural commodities, such as rice, coffee, tea, black pepper, cashew, cassava and rubber. In recent decades, Vietnam has also become one of the main exporter of aquaculture products. Horticulture and floriculture presents an interesting new growth market for Vietnam's agricultural sector.

However, it is expected that in the coming years employment in the primary agricultural sector will decrease due to a diversification of rural livelihoods. Nevertheless, the agro-industry's share is expected to grow and the overall agri-food industry (including food processing) will still account for 35% to 40% of employment in the early 2030s. Growth in the agricultural sector is expected to continue, but demand is changing.



Factsheet: Circular Economy Vietnam – CREM / Partners for Innovation, February 2018

The sector faces the following challenges:

- Food safety is a growing concern for Vietnamese consumers. Pesticides, herbicides and fertilizer are excessively used.
- Overall agricultural productivity in Vietnam is relatively low. The agricultural sector is disproportionately affected by climate change.
- The expansion of the agricultural sector in Vietnam has led to deforestation and soil degradation.
- Water quality and availability causes several problems for the agricultural sector.

CE opportunities for Dutch businesses

In the agricultural sector, many opportunities exist for circular practices and business models. Because the sector is largely based on biotic cycles, many practices in the sector can already be classified as circular. Nevertheless, from the scoping study the following opportunities were identified:

- Consultancy services on biomass resource mapping and circular strategies;
- Local production of organic fertilizer;
- Use of stronger seed varieties to eliminate the excessive use of pesticides, herbicides and fertilizer;
- Climate smart technologies and services;
- Climate controlled agricultural production with greenhouse technologies;
- Cattle breeding technologies and services;
- Urban agriculture around Hanoi and Ho Chi Minh City;
- Smart technologies for small-scale agriculture, providing enormous benefits in terms of efficiency and sustainability.

Logistics

The logistics sector is one of the fastest growing sectors in Vietnam, but still at an early development stage. The demand for logistics services in Vietnam is growing rapidly and the sector is estimated to grow at a higher pace than overall GDP growth in the coming years. Currently, the logistics sector already accounts for 15-20% of GDP in Vietnam. Hanoi and Ho Chi Minh City are the main logistic hubs. Particularly investments in the manufacturing industry have been driving the country's demand for international transport and logistics services. Moreover, a growing middle-class and growing population have been driving demand for domestic transport. Cold chain logistics services have a high potential to grow in the nearby future.

The sector faces a number of challenges:

- For international transport, Vietnam relies heavily on sea freight;

- The vast majority of domestic transport takes place via road;
- Improvements in the national road infrastructure are necessary to meet the demand of the growing logistics sector;
- The logistics sector in Vietnam is fragmented;
- Warehousing facilities are underdeveloped;
- The expansion of the logistics sector has been accompanied by significant environmental impact.

CE opportunities for Dutch companies

In the logistics sector, circular opportunities are less evident than in the agricultural sector. However, opportunities exist that benefit both the competitive position of the sector and a circular economy. Opportunities cover the following areas:

- Sustainable packaging, climate controlled (cold chain) logistics and technologies;
- Warehouse Management Systems;
- Fuel efficient trucks and buses;
- Sustainable airport development;
- Sharing platforms for logistic services;
- Municipal Solid Waste management services;
- Recycling technologies, for used cars, tires and plastics.



Renewable energy

The energy economy in Vietnam is changing rapidly. Vietnam has a large range of primary energy sources such as crude oil, coal, natural gas and hydro power. In 2015, the primary energy supply in Vietnam consisted of 35% coal, 28% oil, 14% natural gas, 17% biomass and 6% hydro. The industrial sector is the main consumer of primary energy (43%), followed by the residential sector (30%) and the transportation sector (23%).

The sector faces the following challenges:

- Vietnam has become a net importer of power;
- Demand for electricity is rapidly growing;
- The Vietnamese power sector is dominated by the EVN. Almost all households in Vietnam are

Factsheet: Circular Economy Vietnam – CREM / Partners for Innovation, February 2018

attached to the national grid;

- Electricity prices are set below cost price and feed-in-tariffs in Vietnam are one of the lowest in the world;
- Grid-connected energy projects are often not-bankable for foreign investors;
- Net metering is introduced to stimulate the development of rooftop solar PV.



Vietnam has good potential for renewable energy. Vietnam is considered to have the best wind resources in Southeast Asia and therefore Vietnam has great potential to develop and generate wind energy. Both on- and off shore wind show good potential with sufficient wind year round. Vietnam's agricultural activities result in vast amounts of agricultural waste, resulting in a relatively high potential for biomass energy generation. While Vietnam has largely exploited its potential for large-scale hydro power generation, small hydro power generation (up to 30 MW) still provides significant potential.

CE opportunities for Dutch companies

A circular economy is powered by renewable energy. From the scoping study the following opportunities are identified that have the potential to enhance the circularity of the sector:

- Consultancy services on biomass resource mapping;
- Improve energy efficiency;
- Solar PV with net metering;
- Consultancy services on the energy transition;
- Captive business models in biomass to energy.

Water management

A large percentage of Vietnam's GDP depends on water. It is of primary importance for food and health and contributes as a key resource to economic activities. Water sustains the agricultural and industrial sectors, including energy production, logistics/navigation and tourism. Agriculture is responsible for 80% of water use, followed by industrial water use (15%), households (3%) and services (2%). Only a small share of urban wastewater

is treated (10 percent), and an even smaller share (4 percent) of septage (septic tank sludge) is safely disposed. Industrial zones discharge an estimated 1 million cubic meters of untreated wastewater a day directly into receiving water bodies. Over the next 15 years urban wastewater is expected to account for the largest share of effluents (about 60 percent). Industrial wastewater (25–28 percent) and rural wastewater (12–15 percent) follow.

The sector faces some major challenges:

- A growing water demand resulting from agricultural production, aquaculture, urbanisation, industrialisation, tourism development and population growth;
- Water pollution resulting from urban waste water (main contributor), wastewater from industry, aquaculture and the polluting effects of fertilizer and agrochemical runoff in rural areas;
- Climate change will sharply increase salinity intrusion in coastal areas, hurting crop yields.

CE opportunities for Dutch companies

Circular economy opportunities in the water management sector range from 'building with nature' opportunities in case of climate adaptation strategies, to the recovery of nutrients from waste water sludge. Opportunities with regard to climate adaptation and desalination are already being addressed by Dutch businesses participating in strategic partnerships, like the 'Mekong Deltaplan'.

Opportunities regarding circular economy and water utilities (supply of drinking water and waste water treatment) include:

- Water purification and water re-use techniques (closing the water loop);
- Recovery of nutrients from waste water (closing the materials loop);
- Heat recovery from water distribution and energy recovery from waste water treatment.

These opportunities are supported by Vietnam's Green growth policy and policies on water supply and water sewage in urban centers and industrial parks. To benefit from these opportunities, companies may be able to build on:

- Existing Dutch-Vietnamese cooperation, like the 'Mekong Deltaplan' and the 'Vietnamese Climate Adaptation Partnership';
- City partnerships, like Amsterdam-Hanoi and Rotterdam-HCMC;
- Water management inclusive trends, like the growing focus on smart cities;
- The focus on industrial symbiosis within economic zones;

Factsheet: Circular Economy Vietnam – CREM / Partners for Innovation, February 2018

- The need for improved water management in major tourist destinations, like Ha Long Bay;
- Dutch cooperation on circular economy and water management in the region, like the cooperation with ReCirc Singapore. This cooperation may serve as a 'hub' to Vietnam for Dutch companies based in both countries.

Smart cities

The concept of smart cities is about scalable solutions that take advantage of information and communications technology (ICT) to increase efficiencies, reduce costs, and enhance quality of life in cities. The interest in the smart city concept in Vietnam is triggered by the rapid process of urbanization and the resulting challenges. Between 1991 and 2014, Vietnam's official urban population doubled from 14 million to 30 million. The smart city concept is still relatively new to Vietnam, but the number of initiatives is growing. In Binh Duong province, Brainport Eindhoven and Becamex IDC Corp have worked together on developing a smart city in the region. In May 2017, a training program on Smart Sustainable Vietnamese Cities (SSVC) has been designed and launched in Vietnam, involving the Hogeschool Utrecht (HU).



Cities in Vietnam face the following challenges:

- Water pollution. Urban wastewater one of the largest contributors to water pollution;
- Air pollution due to traffic and the growth of fossil fuel energy consumption by industry and coal-fired power plants in northern Vietnam;
- Traffic congestion;
- Land use, environmental impacts and loss of raw materials due to landfill and burning of municipal and industrial solid waste;
- Social-economic challenges and health hazards in the nearly 3000 villages which specialize in recycling discarded plastic and other waste materials, like electronics (e-waste). The people involved (operating in the informal sector) tend to be socially marginalized, tend to live on or near garbage

disposal sites, and are exposed to environmental and safety hazards.

CE opportunities for Dutch companies

The concept of smart cities offers opportunities to Dutch businesses that can provide the knowhow, products and services that contribute to *sustainable* smart cities, addressing the current challenges. The National Green Growth Strategy and the National Waste Management Strategy provide a policy framework for green and circular initiatives.

Opportunities include:

- Circular City baseline assessments; identifying the opportunities for and benefits of circular strategies in smart city initiatives;
- Circular building concepts and materials;
- Smart lighting solutions, including smart LEDs;
- Smart urban mobility systems, including smart planning, multi modal solutions and car sharing;
- Inclusive (involving the informal sector), environmentally sound solid waste processing and recycling technology;
- Urban mining concepts and technologies (e.g. Closing the Loop);
- (Online) asset sharing platforms;
- Closing water loops (see 'Water management');
- Renewable energy solutions (see 'Renewable energy').

To benefit from these opportunities, businesses can build on existing Dutch-Vietnam cooperation on smart city development (e.g. Brainport Eindhoven in Binh Duong), city partnerships (e.g. Amsterdam- Hanoi, Rotterdam-HCMC) and the experience of Dutch businesses on smart city related sustainability topics in Vietnam (e.g. Royal HaskoningDHV on water management, Philips on smart lighting, AEB AfvalEnergieBedrijf on waste management), in other Asian countries (e.g. TNO on smart logistics in China) and in other regions (e.g. Closing the Loop on urban mining).

More information

For more information on Vietnam's circular economy opportunities and the available instruments to support Dutch businesses, please contact the economic section of the embassy at:

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