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Batik Waste Water Pekalongan

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FINAL REPORT

BATIK WASTEWATER SOLUTIONS, PEKALONGAN

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The Water Agency has been assigned by the Rijksdienst voor Ondernemend Nederland (RVO) and the Embassy of the Kingdom of the Netherlands to support the local government and batik industries in Kota Pekalongan (City of Pekalongan) in exploring potential Dutch water solutions to address batik wastewater problems.

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The Water Agency Disclaimer

This Final Report summarises the on-the-ground activities conducted by the consultants from June 2022 to February 2023. The recommendations made by The Water Agency in this report are based on the conclusion drawn from information collated through primary and secondary research, our knowledge of the batik industries and local government's needs and interests, and discussion with relevant stakeholders.

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Reading Guidance

Report

This Final Report is part of a continuation of the collaboration between the Indonesian and the Netherlands governments, focusing on Pekalongan Batik Wastewater.

Previous studies were done by Deltares (scoping) and Royal HaskoningDHV (technical solution recommendation). This report focuses on creating an enabling environment and matching the local needs through community engagement and visits to the available wide-range expertise from the Netherlands.

Solutions

Solutions here are not specific only to technical solutions but rather to other non-technical solutions that could inspire and answer the locals' needs and interests toward a more sustainable water use and wastewater treatment.

Batik

Batik in this report refers to the stamped and hand-written batik and the combination of both. Other than the three types, the batik community deems them as an imitation of batik products.

Batik is a process of drawing decorative patterns on a piece of cloth with wax, then coloured with a combination of colours unique to each location. The process of making batik is not unique to only one area. However, the creation and combination of patterns, motives, and colours contain traces of one area's identity.

Assignment boundary

The project location is within the boundary of Kota Pekalongan (Pekalongan City). Thus, it falls under the authority of the Kota government. Limited to no communication and dialogue were initiated with Kabupaten Pekalongan (Pekalongan Regency).

Glossary

ASEPHI	Asosiasi Eksportir dan Produsen Handicraft Indonesia / Association of Indonesian Handicraft Exporters and Producers
Balitbang	Badan Penelitian dan Pengembangan / Research and Development Agency
BBKB	Balai Besar Standardisasi dan Pelayanan Jasa Industri Kerajinan dan Batik a.k.a. Balai Besar Kerajinan dan Batik / Center for Standardization and Services for the Handicraft and Batik Industry
Bappeda	Badan Perencanaan Pembangunan, Penelitian, dan Pengembangan Daerah / Planning Agency
Dindagkop-UKM	Dinas Perdagangan Koperasi dan Usaha Kecil Menengah / Cooperative and Small and Medium Enterprises Trade Agency
Dinkominfo	Dinas Komunikasi dan Informatika / Communication and Information Agency
Dinparbudpora	Dinas Pariwisata, Kebudayaan, Kepemudaan dan Olahraga / Tourism, Culture, Youth and Sports Agency
Dinperinaker	Dinas Perindustrian dan Tenaga Kerja / Industry and Manpower Agency
DLH	Dinas Lingkungan Hidup / Environmental Agency
DPUPR	Dinas Pekerjaan Umum dan Penataan Ruang / Public Works and Spatial Planning Agency
Dinas ESDM Serayu	Cabang Dinas Energi dan Sumber Daya Mineral Wilayah Serayu Utara
IPAL	Instalasi Pengolahan Air Limbah / Wastewater Treatment Plant
Kabupaten	Regency of Pekalongan
KADIN	Kamar Dagang dan Industri Indonesia / Indonesian Chamber of Commerce and Industry
Kota	City of Pekalongan
Paguyuban	Association
PAMSIMAS	Penyediaan Air Minum dan Sanitasi Berbasis Masyarakat / Provision of Community-Based Drinking Water and Sanitation
PCCF	Pekalongan Creative City Forum
PDAM	Perusahaan Daerah Air Minum / Local water company
WWTP	Wastewater treatment plant

Executive Summary

Phase 1: Determine the local requirements for matchmaking and opportunities for possible solutions

The starting point and foundation of our project was to identify shared interests and requirements between various stakeholders towards specific approaches and solutions to tackle batik wastewater pollution. As we established through many discussions with government agencies, batik industries and other relevant parties (see detailed overview below), we identified that the interests, ambitions and requirements between the main stakeholders in Pekalongan are quite far apart. The general motivation to address pollution from batik wastewater is limited (lots of finger-pointing at who's to blame, and many get angry when you bring up the topic!), government agencies do not work together, and there is significant distrust between the batik producers/community and the government.

At the core, all water-related problems facing the batik industry in Pekalongan are interconnected with and rooted in a broad variety of factors such as the weak/vulnerable socio-economic position of the (many small) batik producers, lack of policy and regulation enforcement, lack of shared identity and vision on Pekalongan as a 'batik capital' (producers are very proud of their batik but they have a weak market position relative to suppliers and buyers), lack of public-private collaboration, lack of sustainable batik production/operating standards, lack of awareness and education on 'green batik', lack of 'green batik' champions/role models, lack of innovation dynamics (e.g. new technologies for more sustainable dying, water and energy use, etc.) and lack of collaboration between government agencies, both within the Kota as well as between Kota and Kabupaten.

Our conclusion from this phase is that addressing wastewater on its own has little merit. All previous efforts (GiZ, REDD+, DLH) have failed or had a short-lived impact because they had no inclusive buy-in and were poorly supported to become sustainable (e.g. no training, no maintenance), or did not reflect and connect with the market demand. If we want to successfully engage stakeholders with wastewater and create an opportunity for new (Dutch) treatment solutions to be introduced and implemented, we have to address it as part of a more integrated approach that recognises the factors as mentioned. Above anything else, the approach should deliver a concrete and tangible up-side for the batik producers (i.e. the potential to earn more income); otherwise, they will not/cannot change their current practices.

Clearly, it is not our role to initiate and develop such an integrated approach. However, we have identified a number of 'entry points' that we believe are worthwhile to develop and support:

1. Communal Wastewater Treatment

DLH (Kota's environmental agency) is keen to have support for the operation and expansion of the communal wastewater treatment plants. There appeared to be an implicit expectation that the Dutch would 'give them' a new plant, but they have accepted that Technical Assistance from the Netherlands is a good starting point to improve the existing plants and do a proper analysis and

design for a new plant – which should not only consider the current wastewater situation but also look at future scenarios of more sustainable batik production. From this process, we may identify more opportunities for specific (Dutch) technologies to be introduced.

2. Green Batik Champions

We have identified interest and initiative by several individual batik producers to become more sustainable. We believe they can be very important as potential Green Batik Champions. We have built good relationships with them and have their trust to collaborate.

3. Green Batik Standard

The national government is undertaking the development of a new green batik standard, which is gaining some traction. One of the components of that standard is how the batik wastewater is being treated, i.e. the wastewater has to be treated with a communal or household water treatment plant. This regulation would offer incentives to standardised batik industries. We believe this process could offer more incentive/push for change and innovation and potentially give us more concrete ‘hooks’ to introduce water-related solutions.

4. Green Batik Pilot

Bappeda has expressed a strong interest to develop a more forward-looking vision of Pekalongan as a green batik capital in Indonesia and support/promote concrete ‘pilots’ by batik producers. These pilots would be showcases of how batik can be produced more sustainably, which includes reducing the water footprint and reducing the pollution of water. We think this is an important initiative to support.

Phase 2: Identification and selection of appropriate solutions and opportunities

Based on the findings of Phase 1, we have identified a range of potential solutions and opportunities:

1. Communal Wastewater Treatment

This is one of the most critical components in the existing wastewater system in Pekalongan and realistically the only part of the system that has potential for short-term improvement. Given the scale and configuration of these treatment plants, we have contacted the experts from the Dutch Water Boards to see if wastewater treatment could be included in the planned Blue Deal program in Indonesia (which is planned to start in 2023). We had several meetings/calls with them to explain and discuss the situation and in June 2022 we accompanied them for a visit to Pekalongan to assess the situation on-the-ground. We agreed to organise a technical mission in November 2022 (see Phase 3). In addition, we have contacted several Dutch companies that offer wastewater treatment solutions for textile, including DyeCoo, NX Filtration and Kemeo. As we found, these solutions are not fit for small-scale implementation (by individual batik producers) but could fit a communal

treatment approach, depending on how the existing communal wastewater treatment plants will be further developed in the future.

2. Green Batik Champions

Promoting and supporting batik entrepreneurs to become more sustainable and become role models for other batik companies is an important part of the overall solution. To support the batik companies in Pekalongan, we have identified several Indonesian entrepreneurs that already demonstrate that textile production can be sustainable and profitable. We have organised for these companies to share their experiences with the Batik community and agreed for a field visit/knowledge sharing event to take place in November 2022 (see Phase 3).

3. Green Batik Standard

As this newly revised standard is such an important potential driver for sustainability in Pekalongan, we have developed contact with several of the key partners that are part of the green batik standard development:

- a. Pekalongan University
- b. Dinperinaker Kota Pekalongan
- c. Dindagkop-UKM Kota Pekalongan
- d. DLH Kota Pekalongan
- e. Dinparbudpora Kota Pekalongan
- f. KADIN Kota Pekalongan

4. Green Batik Pilot

The Batik communities themselves can offer an important part of the solution by adopting the green batik standard and showcasing to other companies and communities how this can be achieved. We have actively developed relations with potential batik villages to create enthusiasm for a pilot project approach. During the annual Batik Day (2 October), which is a major city-wide celebration, we have offered a small sponsorship to several villages to support activities aimed at promoting sustainable batik.



Figure 1 Batik Day celebration in Kampong Batik Pesindon and Kauman

As a result, we have identified one community – Kampong Batik Kauman – that offers the best opportunity to develop as a successful green batik pilot project. We have agreed to bring several solution partners together in November 2022 to scope this potential pilot (see Phase 3).

Phase 3: Matchmaking and Next Steps

Based on the findings of Phase 1 and 2, we have organised two matchmaking events in November:

1. Green Batik Forum

On Monday 14 November 2022, we organised a Green Batik Forum in Pekalongan. Working together with Bappeda, DLH, and the batik community, this forum brought together all local stakeholders, including the city government (Kota), regional government (Kabupaten), university and the

batik producers. At our invitation, we introduced several ‘solution providers’ at the forum to present their ideas and solutions:

- a. Dutch Water Boards to present solutions for wastewater treatment (technology but also models for monitoring, inspection, tariffing, etc.)
- b. Indonesian Textile Entrepreneurs to present innovative, sustainable models for textile production and marketing
- c. Pekalongan University to present the new national Green Batik Standard
- d. Local Batik ‘Champions’ to present how they are developing more sustainable textile production models, e.g. using natural dyes, green certification and international ‘green’ branding of products.

The full-day event was attended by more than sixty people and opened by the Mayor of Pekalongan. Besides presentations, we facilitated networking between people and organisations and an interactive session for all participants to contribute ideas and suggestions for follow-up activities.



Figure 2 Green Batik Forum in Pekalongan

2. Wastewater Treatment Technical Assessment

During three days, on 15-17 November, we organised a Technical Assessment of the existing communal wastewater treatment plants across the city, supported by experts from the Dutch Water Boards (Water Board Noorderkwartier and Water Board Zuiderzeeland). The assessment aimed to identify the opportunities for the communal wastewater treatment plants to be improved, while also identifying how these plants can support the batik communities to reduce their water footprint, for example by re-using the treated wastewater and combining this with centrally supplied water by PDAM to reduce groundwater extraction.

3. Scoping of Potential Green Batik Pilot Project

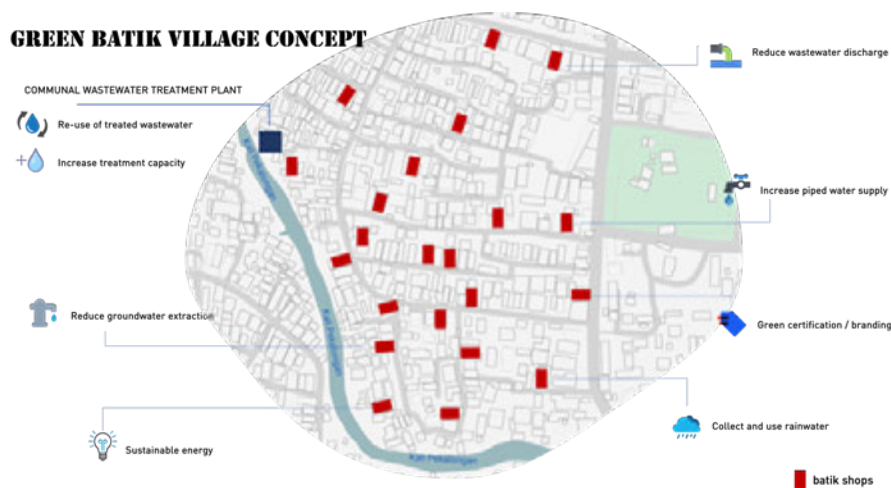
On 17 November, we hosted a workshop at Bappeda to discuss and scope a potential Green Batik Pilot project in one of the batik villages (Kampoeng Batik Kauman). This pilot would offer an excellent opportunity to implement and test several solutions and approaches related to improved communal wastewater treatment, reducing the water footprint of batik production, implementing the Green Batik Standard, testing innovative production technologies (such as natural dyes) and establishing a stronger “Green Batik”

brand for Pekalongan. The pilot may also offer a ‘context’ for new (Dutch) solutions to be introduced.

Green Batik Village Pilot Project

To complete our assignment, we have worked with one of the local batik communities (Kauman), Bappeda and DLH to design and plan a Green Batik Pilot Project. The deliverables are a concept design with potential interventions/solutions and a preliminary budget/resourcing and planning outline.

Below is a high-level summary of the key elements of the pilot project. Details can be found in section 3.2 of this report.



Pilot Project Workshop

In February 2023, we visited Pekalongan and organised a more in-depth workshop sessions to validate our findings and discuss the potential of running the Green Batik Pilot Project with Kauman batik community (Paguyuban). We are looking at Kauman Village as the starting point to slowly change the batik producing process. Kauman Green Batik Village is a pilot project aimed at achieving a green batik village by providing and guiding the Kampong Batik Kauman through several suitable interventions in the batik process and post-batik process. This pilot would bring positive impact to the water body and environment for more than 800 batik industry workers in Kauman.

Pilot Project Plan

Five identified entry points in Phase 2 has been summarised into four main objectives for the Pilot Project: (1) Improve the water management in the batik process, (2) Adapt the Green Batik Standard into the batik process, (3) Identify and develop green batik market (local and international), and (4) Promote green batik process in other Pekalongan villages. In initiating the project, Kauman would need to be supported through practical guidance and facilitation to exhibit promising results and build their confidence. We have listed potential interventions throughout the

process and post-process of batik (see Phase 3). All interventions are planned for two years and are divided into four phases as follows (see figure 4). The estimated budget for a 2-year pilot is approximately €300,000.

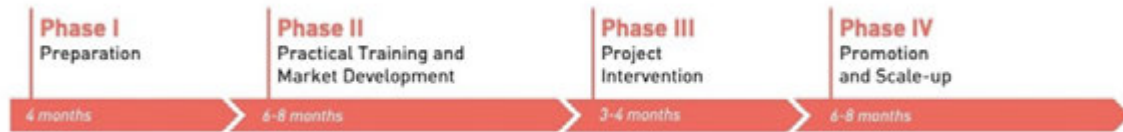


Figure 3 Pilot Project Timeline

Table 1 Project phasing and interventions

Phases	Activities/ Interventions	Duration
Phase 1 – Preparation	<ul style="list-style-type: none"> Green component assessment Green level database 	4 months
Phase 2 – Practical Training and Market Development	<ul style="list-style-type: none"> Environmentally friendly dyes Biogas energy Wax reuse Rainwater harvesting Treated wastewater reuse Surface water from PDAM 	6-8 months
Phase 3 – Project Intervention	<ul style="list-style-type: none"> Market networking event Green batik tourism Digital marketplace and tools Green batik exhibition Green batik label/ certification 	3-4 months
Phase 4 – Promotion and Scale-up	<ul style="list-style-type: none"> Evaluation, improvement, and replication of Phase 2 and Phase 3 	6-8 months

The Pilot Project looks at a mix of stakeholders to be involved and engaged to succeed. Participatory and inclusive engagement always needs to be the primary approach. Constant and regular on-the-ground activities need to be organised continuously by someone trusted by the key stakeholders to ensure commitment and to motivate the efforts.

For the local community in Kauman and stakeholders in Pekalongan, seeing is believing. In the future, part of the batik process will need to change to ensure they can still produce batik and uphold its cultural and historical value while maintaining a habitable environment for future generations. Green batik it is!

1 Phase 1: Determine the Local Requirements for Matchmaking and Opportunities for Possible Solutions

For Phase 1, we are focusing on the needs, solutions, and stakeholders, then connecting the pieces of information to understand the underlying issues and interests of the people in Pekalongan. Solutions that have been mapped in previous studies are used to validate findings throughout the next visits.

1.1 Activities on the ground

Table 2 shows the time frame of chronological visit activities on the ground from June to November 2022. Following the project scope, which stays within the boundaries of Kota, there is limited interaction with the stakeholders in Kabupaten.

Table 2 Activities on the ground

Activity	Engaged stakeholders	Meeting/ visit objectives
Meeting and site visit 2-4 June	<ol style="list-style-type: none"> 1. Government agencies from Kota 2. Government agencies from Kabupaten 3. Dutch Delegated Representative Water 4. Blue Deal team (with HHSK, HHD, DWA) 5. Water utility (PDAM) 6. River basin organisation (BBWS Pemali-Juana) 	To inform Pekalongan stakeholders on ongoing and future collaborations.
Meeting and site visit 5-7 July	<ol style="list-style-type: none"> 1. Government agencies from Kota 2. Forum for Economic Development Employment and Promotion (FEDEP) Kota 3. Kali Loji Care Community (KPKL/ Komunitas Peduli Kali Loji) 4. Batik community/ industry 	To interact with government stakeholders and batik communities, to inform them on ongoing collaboration, to assess needs and validate previous studies, to identify preliminary issues.
Meeting and site visit 9-12 August	<ol style="list-style-type: none"> 1. Government agencies from Kota 2. Batik community/ industry 3. Jenggot water treatment plant 4. Kauman water treatment plant 5. Museum Batik 6. Batik historian/ artist 7. Pekalongan University 	To understand the views, needs, and priorities of batik industries, to understand the plant operation and process, to understand the plant's "customers".
Meeting 22 September	<ol style="list-style-type: none"> 1. Natural dye institute (INDI UGM) 2. Batik community/ industry in Jogjakarta 	To understand how other batik actors look at Pekalongan.
Online meeting 26 September	<ol style="list-style-type: none"> 1. Government agencies from Kota 2. Pekalongan University 3. Batik community/ industry 	To inform on previous visits' findings, to brainstorm ideas on

Activity	Engaged stakeholders	Meeting/ visit objectives
		engaging batik industries and communities.
Meeting and site visit 2-5 October	<ol style="list-style-type: none"> 1. Pesindon batik village 2. Kauman batik village 3. Pekalongan University 4. Batik historian/ artist 5. Pekalongan exporters and handicraft producers' association (ASEPHI) 	To support batik communities on batik day, to build relationships with Pekalongan stakeholders, to brainstorm, explore, and develop plans for working with batik industries.
Meeting 20-21 October	<ol style="list-style-type: none"> 1. Pesindon batik village 2. Kauman batik village 3. PT. Telekomunikasi Indonesia (Telkom) Pekalongan 4. Government agencies from Kota (Bappeda and DLH) 	To attend the peak event of Batik Day celebration held by Kampoeng Batik Kauman and Kampoeng Batik Pesindon, to discuss the agenda of Blue Deal visit to Pekalongan with Bappeda and DLH.
Meeting and site visit 14-17 November	<ol style="list-style-type: none"> 1. Government agencies from Kota 2. Government agencies from Kabupaten 3. Blue Deal team (Water Board Noorderkwartier and Water Board Zuiderzeeland) 4. Dutch Delegated Representative Water 5. Pekalongan University 6. PCCF 7. Batik community/ industry 8. Bell Society 	To get input and ambitions on sustainable batik from different stakeholders, to assess the condition of the existing wastewater treatment plans, to identify the opportunities for the communal wastewater treatment plants that are to be improved.

1.1.1 Meeting and Site Visit 2-4 June

Project and personnel introduction

The meeting served as an introduction round for the stakeholders and the project. The stakeholders agreed that the batik wastewater problem had been around for quite some time, and it had received complaints from the batik industries.



Figure 4 Project kick-off meeting

One of the visited wastewater treatment plants was the Banyurip treatment plant which used a mix of biological processes and constructed wetlands.

1.1.2 Meeting and Site Visit 5-7 July



Figure 5 Meeting in Bappeda Office with various stakeholders

Untreated wastewater flowed from Kabupaten to Kota

The agencies in Kota commented and insisted on inviting Kabupaten to discuss the wastewater issue since the batik printing factories are located mainly in Kabupaten. They were quite adamant that the wastewater issue should be solved from the Kabupaten side first. The agencies were pessimistic about solving the batik wastewater issue from the batik industries in Kota, stating that the impact would not be much.

From the business industry's perspective, it was also noted that since Covid-19 hit back in 2020, the production volume in Pekalongan has decreased significantly, if not stopping at all. Within the batik industries, it was noted that 95% of business has halted production and have just begun to get back on their feet.

Supporting the claim from government agencies, the batik communities noticed that during the time they did not produce anything, the water in the Pekalongan rivers was still dark. The dark colour itself is an indication that batik production was happening. This led to suspicion that the production was done by the batik printing and jean washing industry from the upstream area or the Kabupaten.

Based on information from Bappeda, Kabupaten and Kota, both are working on joint research to determine where the pollution starts entering the rivers in Pekalongan. There was also a notable conflicting comment from each side. Kota mentioned that the water came from upstream and Kabupaten, while Kabupaten said there is no indication that it is the case. The joint research was hoped to identify the starting point of wastewater pollution and verify each other's claim.

Insufficient wastewater treatment capacity

DLH operates four water treatment plants in Jenggot, Kauman, Banyurip, and Pringlangu, with different treatment processes and scales. DLH noted that the drainage system between batik wastewater and household wastewater is not separated, which causes poor wastewater management where the batik industry habit is to dump their wastewater directly to open channels. Around 80% of the wastewater circulating in Kota came from the batik industries.

DLH had expressed that their capacity is insufficient to treat all the wastewater, resulting in treated water being remixed with untreated water in the river. There has been a plan to build a new water treatment plant, and the detailed engineering design has been completed as well. They expected that the funding could come from the IN-NL collaboration.

Other agencies in Kota suggested that wastewater should be controlled or prevented to some extent from the upstream process, such as ensuring the use of more sustainable or better-quality raw materials (dye, cloth, and wax) to reduce pollution at the end of production.

Law enforcement improvement

The government agencies suggested having strong regulations and law enforcement in place. Upon deeper discussion, these regulations are already in place, but law enforcement is still low. The most significant factor seen as the obstacle in enforcing the law is that several batik workshops do not have the capacity and ability to follow the regulations, thus forcing them would mean closing the business. Despite the obstacle, the agencies still agree that further regulation and law enforcement should be established.

Demand driven batik production from buyers

We also highly noted that Pekalongan batik industries are proud producers. The industries are very creative in accommodating and catering for the market demands for colour and design. Most of their products are not labelled, as ordered by businesses from Jakarta, Jogjakarta, Bandung, Bali, and other popular tourist destinations. It can be said that Kota Pekalongan is the “kitchen” for these batik productions.

The same remark also came from DLH, which mentioned that the batik industries could change their way of producing batik if the demand from buyers exists. Selling batik as an art piece where the artists design their own creations (not focused on the market trend and demand) is a very niche market in Pekalongan, even though the selling price might be a hundred times higher.

Guarded reaction towards wastewater issue

When the topic of wastewater was brought up, we noticed some guarded reactions from the batik industries. Some mentioned that the ‘real’ batik, i.e. stamped or hand-written or a combination of both, will not produce much waste and wastewater because the production process is very time-consuming.

The visited batik industries then mentioned that before the batik printing and jean washing came to business, the river was clear and did not emit a foul odour. It was again suggested to take action for the industries in Kabupaten (where the jean washing and batik printing are operating).



Figure 6 Meetings with batik industries

It was also mentioned that wastewater treatment should be a free service provided by the government, with connected lines to the treatment plant. Although some of these industries have their own wastewater treatment plant in their workshop, it was never really checked or evaluated (they assumed that clear water means no pollution).

On the other hand, the government stakeholders claimed that they had tried to educate the batik industries not to dump the wastewater into the drainage or other open channel to no avail. Dumping the wastewater into the channel, which led to the river, was easier and faster. DLH planned to build a dedicated wastewater line to connect batik industries to the treatment plant, but it would need massive construction work around the city, for which they did not have the budget.

Two of the batik industries mentioned that they had started to explore using natural dye to reduce chemicals in their batik product. However, unlike the chemical dye, the natural dye did not produce or bring out a bright colour. Although some customers are interested in buying natural dye batik, the more extensive market still lies in the bright colour batik.

1.1.3 Meeting and Site Visit 9-12 August

Unused household wastewater treatment plant

Between 2010 – 2015, DLH built 63 units of an individual water treatment plant. Upon field visits, we found some inconsistencies between the locations on the data and the locations on the ground. We managed to mark one of the individual water treatment plants, which was installed inside Batik Larissa.

The water treatment plant was provided free of charge by DLH. After the installation, staff from DLH did regular checks for a short period of time (3-6 months), then never again. Batik Larissa workshop still uses the individual water treatment plant, but they never evaluated or checked the output water quality.

Batik Larissa hoped that the monitoring and evaluation by DLH staff could continue and provide them with information and skill to maintain the individual water treatment. DLH does not provide emergency contact or customer services to the batik industries with individual water treatment plants where they can report or ask for help.

Other batik industries are supportive and happy to be provided with individual water treatment plants if it costs nothing, easy to use, and come with an operating guideline. There was a lack of enthusiasm to treat their wastewater on shop-level. Additionally, it was not enforced and did not give any incentive for the industry to adopt the change of routine. For the industries, this was another time-consuming process they wanted to avoid and better to have it at the communal level.

Utilization of communal wastewater treatment plant that has not been maximised

Jenggot water treatment plant (IPAL Jenggot) was built to serve the scattered batik home industries around the area. The batik industries habitually dump their wastewater into the open channel directly, which would later flow into the water treatment plant. The channel was merged with domestic wastewater, resulting in higher wastewater to treat (over capacity), and some of the wastewater then flowed directly to the river untreated.

Jenggot uses the natural treatment method, with natural plants and activated stones, to absorb the toxin and clear the water. The process takes a long time (a full working day) to treat the water and needs a vast area to accommodate everything. After being treated, the treated water flows to the river and merges with the still-polluted water. They operate from 8 am until 4 pm.



Figure 7 Treated wastewater from WTP (left) vs. wastewater from regular pipe in the neighbourhood (right)

A great example of centralised wastewater treatment was showcased in the Kauman water treatment plant (IPAL Kauman). Each batik workshop is connected to the wastewater treatment plant through a dedicated line of pipes. The plant is dedicated only to treating batik wastewater. Thus, before being treated with bacteria (aerob/ anaerob process), the remaining wax in the wastewater can be collected and sold.

The effectiveness of IPAL Kauman is high, and the plant is running 24/7, powered by electricity. The cost of running IPAL Kauman is the highest among the other wastewater treatment plants in Pekalongan.



Figure 8 Kauman WWTP (left) and treated wastewater from WWTP (right)

It had been the Kauman batik community's wish to reuse the treated wastewater in the batik production process. One of the community representatives had also sought some existing technology to help realise the idea (nuclear pollutant separator from BRIN/ Indonesian Research Agency and nanobubble technology). Still, they also expressed that funding or putting down the initial investment would be hard for them.

Both IPAL's water quality output is monitored and evaluated monthly by DLH. We noted that the DLH staff running both plants are very skilled in explaining the process to general people. They also tried to educate the locals about the treatment process; thus, no protest came from the community about the facility.

Training, aid, and assistance to develop market

After Covid-19, the batik industries in Pekalongan are picking up again, with notable more than 50% of the industry have started to see a positive, steady number of increasing orders. However, the increasing number has not reflected their number before the pandemic hit. To increase sales, the industry is now exploring the international market and is keen to export to potential countries.

The batik industries in Kota consist mostly of sellers and some producers; thus, their immediate interest lies in the market opportunity, demand, and trends. The batik industries are enthusiastic about discussing what other training, aid, or assistance might be available to them to revive the post-pandemic batik market.

From our discussion, there was limited information and instrument available for or known by the batik industries to understand the export requirements or standards in different countries. However, some who joined the “Aku Siap Ekspor” (an initiative led by the national government and institutions) had joined other training to enter the export market.

Though the main driver of change for the batik industries in Pekalongan is socio-economic interest, they also understand and experience the impact of unsustainable water use and poor water management. Pekalongan coastal area has suffered from the prolonged effect of tidal flooding, with traces seen permanently in some parts of the city. We also noted skin rashes in young kids’ legs during the preliminary site visits. It might be caused by the permanent inundation they experience in their neighbourhood.

Through dialogue with some people in Pekalongan, they feel the urgency of using reused water or other water sources to slow down or stop the land subsidence. Radio Pekalongan regularly reports on the flood happenings in Pekalongan and explains what might cause them. Suffice it to say the people in Pekalongan see the correlation between using groundwater for batik production and land subsidence that leads to more severe coastal flooding.

Awareness raising through batik education and Batik Museum

UNESCO awarded Pekalongan three recognitions: Indonesian Batik in 2009, Best Practices in 2009, and Creative City in 2014. Pekalongan people are very proud of these recognitions, which were almost always mentioned during our discussion. These recognitions are being evaluated regularly and can be revoked if there is a case.



Figure 9 Batik recognitions from UNESCO

The Batik Museum has operated since 2006, years before Kota Pekalongan received batik recognition from UNESCO. Since then, the museum has been used as a mini workshop to educate school children and tourists about batik. The Dinparbudpora

saw Batik Museum's role as the gate opener for batik in Pekalongan, engaging people with the knowledge of batik and the research and development centre.

The Batik Museum was also provided a small wastewater treatment plant by DLH back in 2009. When we visited the museum, the water treatment plant did not operate anymore due to clogging and breakdown. Ideally, the wastewater would be processed by adding chemicals to clean the wastewater before flowing into a channel outside the museum. This breakdown made museum visitors unable to learn about the batik wastewater treatment process.

On the education part, Pekalongan University was mandated by the Directorate General of Education to open a Batik Technology course. Since 2012, they have had hundreds of students from Indonesia and overseas study the batik culture and knowledge. Unfortunately, interest in this program is decreasing year by year.

1.1.4 Meeting 22 September

Pekalongan is recognised as skilled batik producer

Jogjakarta, one of Indonesia's most tourist destinations, is famous for its batik products. Upon visiting Jogjakarta, we validated that Pekalongan was producing the batik sold in Jogjakarta.

A businessman in Jogjakarta, who came from a batik family in Pekalongan, had noted that the batik creation skills in Pekalongan have no match, provided that it is generational skills passed upon generations have a proven quality to it. Additionally, it is also cheaper to continue his production in Pekalongan than in Jogjakarta, which will cost him more money and time.

He also noted that 20% of his buyers have started to ask about the sustainability of batik products, i.e., the materials, production, and packaging. Regardless of the demand, he mentioned that the production in Pekalongan had to be more sustainable so it did not pollute the river further and the business could continue to thrive.

Use of natural dye as colouring alternative

There is a specific market that is looking at the use of natural dye in textiles to be more sustainable. The potential use of natural dye and its market was then explored to see if there was a promising market or appetite for natural dye batik.

There was research led by Gadjah Mada University (INDI UGM) on natural dye use by reusing natural waste materials that are unique to one area as a natural dye. The dye needs to be mixed with other elements to lock the colour to the cloth, and the composition is unique depending on what resources are used.



Figure 10 Natural dye developed by INDI-UGM

Currently, UGM has developed partnerships with several companies in Indonesia to supply and reuse natural waste materials to be turned into a dye. They have also worked with several communities to create a unique market for natural dye products. The most successful example of the natural dyed hand-written batik is the Ciwaringin Village, Cirebon Regency.

1.1.5 Online Meeting 26 September

Revision of the Green Industry Standard for Batik Industry

An existing Green Industry Standard for Batik Industry issued by the Minister of Industry (Peraturan Menteri Perindustrian No. 39 tahun 2019 tentang Standar Industri Hijau untuk Industri Batik) is currently under revision. The revision was made after the gap realization between the standard and the industry's capacity, where only one batik industry in Indonesia can meet the standard and be certified.

The Batik Study Program team from Pekalongan University (the Batik Technology study major) leads this revision effort. Pekalongan University agreed that a workshop to inform the Pekalongan batik industry on this regulation and standard might benefit the batik industry and Pekalongan University.

Batik awareness program

The stakeholders agreed that a program or initiative is needed to bring everyone together and introduce the green production and process standard. The program should be designed and consulted with several stakeholders, i.e. the batik community, several government agencies, and academia. Incentives should also be given to participants as a positive push to start the process (which will be explored further).

A batik industry representative also suggested starting or adding a batik motives competition at the first stage. Under UNESCO’s recognition for Indonesian Batik, the community, academia, and government must commit to preserving, protecting, and developing, which will be evaluated regularly. The batik motives competition would be under development, where new motives could be introduced as the culture’s identity.

1.1.6 Meeting and Site Visit 2-5 October

Annual Batik Day celebration to commemorate and preserve batik

The batik communities and industries commemorate batik day annually to celebrate Batik Day, which UNESCO recognised on 2 October. It is a widely celebrated day in Pekalongan that spans the whole of October month. During the month, the batik villages and governments organised a series of activities to unite everyone, educate and raise awareness to preserve batik as Indonesia’s cultural heritage.



Figure 11 Batik Day celebration organised by Batik Village

This year, the batik communities are focusing on post-pandemic initiatives to revive the batik market in Indonesia and internationally. Several fashion shows and batik markets were organised to showcase batik products with high economic value. The Batik Day was attended by the Governor of Central Java and the Ministry of Cooperatives and Small and Medium Enterprises to show support for Pekalongan batik communities and push for exporting batik to other countries.



Figure 12 Batik Week opening in Pekalongan

Working with universities to explore green batik standard and market

Pekalongan University is currently leading the initiative to revise the existing Green Industry Standard for Batik Industries. They saw the benefits in ‘testing’ the standard through a combination of information session and practical works with batik industries. That way, Pekalongan University could understand the still existing gap and evaluate the revision draft. On the other hand, the batik industries in Pekalongan could be informed on a new, to be regulated standard that would help them assessed and be prepared for the green market potential.

Adding to this, Balitbang also informed us on an initiative by the Ministry of Education, Culture, Research, and Technology that they wanted to explore but had not. The idea was to match academia with business, community, and government, then jointly explored or researched the market trend and demand to support and prepare the batik business.

For the batik communities in Pekalongan, there is an annual batik expo in Jakarta that has the interest of Pekalongan batik shops. The expo is organised by ASEPHI to promote local products around Indonesia, including batik. ASEPHI supported the batik communities in Pekalongan through training that can increase the selling value and identity of their product, as well as be more competitive with other local products for the expo.

1.1.7 Meeting 20-21 October

Peak of Batik Day celebration

Batik Day falls on 2 October, yet the Kota celebrates the commemoration for a whole month with the peak event celebration on 20-23 October.

We were invited to two batik day events. The first one is the event by Kampong Batik Pesindon in Pesindon village that was held on the 20 October. The event was opened by the Major of Pekalongan, followed by a batik fashion show, local music, and other performances. The event was attended by government stakeholders, Batik shop owners in Pesindon, and the community.



Figure 13 Batik Day event in Pesindon opened by the Pekalongan Major (left), and batik fashion show (right)

The second event was the 3-day event by Kampong Batik Kauman in Kauman village, from 21 until 23 October. Similar to the event in Pesindon, the event in Kauman village was attended by the batik shop owner, the village community, and several Pekalongan government stakeholders, such as Tourism Agency and Trade, Cooperatives & SMEs Agency. The event was opened by a speech from xxxxxx, continued by music and local performances. Besides art and music performances, the event also has a night market that sells local food and drink, art & crafts, and batik.



Figure 14 Batik Day event in Kauman village opened by the head of office of Dinperinaker (left), music performances (middle), and night market (right)

To appreciate our support in sponsoring the program, Kampong Batik Pesindon gifted us a customized NL logo-shaped *canting*, which is the stamp to create batik. They also made us some batik fabrics from the NL stamp.



Figure 15 Customize NL Logo batik stamp from Pesindon village

Preparation of Blue Deal Visit

Together with Bappeda and DLH, we planned for the Blue Deal team visit to Kota Pekalongan in November 2022. Blue Deal team planned to have around three-four days to stay in Pekalongan.

We planned to have a discussion forum between the Blue Deal team, government agencies of Kota Pekalongan, and the batik community. This forum was arranged to discuss about the batik waste in Pekalongan. However, based on the previous one-on-one discussion with some batik stakeholders, the term batik waste might create a negative mindset for the community as well as government agencies. Thus, the focus of the forum is to discuss green or sustainable batik in Pekalongan, including wastewater as one of the topics.

The discussion forum aimed to let the Blue Deal team listen to the view of the batik community and government agencies on green batik, including wastewater. The exchange of views between stakeholders then will lead to the discussion of what they can and cannot do to achieve green batik. We believe that the result of the discussion forum will lead to what the Blue Deal, the government, and the community will do for the next step in improving the batik industry in Pekalongan.

The other activity of the Blue Deal visit to Pekalongan was a site visit to several communal wastewater treatments, individual wastewater treatments, and batik villages. The site visit will then be followed by a discussion with the DLH (environmental agencies) of Pekalongan. The site visit and the discussion aimed to show the Blue Deal team about the current situation of Batik industries in Pekalongan, especially from the wastewater side, and to seek what kind of support the Blue Deal team might do for the city. As the wastewater treatment plan was under the jurisdiction of DLH, thus, the Blue Deal team needed to discuss further about the future plan of the wastewater treatment plan with the DLH team.

1.2 Stakeholder's Roles and Responsibilities

Throughout the project, we were introduced with and actively developed new contacts with many different stakeholders to better understand the batik and wastewater issues from many perspectives – governments and communities. Through those meetings and discussions, we can map out the roles and responsibilities of each of these stakeholders, limited only to the batik and wastewater issue.

Government stakeholders

Government agencies mainly relate to batik and wastewater issues based on their limited roles, functions, and responsibilities. During the discussion, at times, these government stakeholders might be defensive and protective of their direct interests under their roles, and they lost sight of working hand-in-hand to achieve goals.

Table 3 Roles, functions, and responsibilities of Pekalongan government agencies

Government stakeholders	Role and responsibility regarding batik and/or wastewater
Badan Perencanaan Pembangunan, Penelitian, dan Pengembangan Daerah (Bappeda) Kota English: Planning Agency	Leading agency on the IN-NL collaboration for batik wastewater. As planning agency, Bappeda coordinates with other agencies on ongoing projects and initiatives. They are also responsible to patch different programs that might prove to be more beneficial if the programs are integrated.
Dinas Perindustrian dan Tenaga Kerja (Dinperinaker) Kota English: Industry and Manpower Agency	Providing workshops/ seminars that could be beneficial for batik industries (online selling, joining export market, increase profit, etc.), issuing batik business permits, informing batik industries on SOPs.
Dinas Lingkungan Hidup (DLH) Kota English: Environmental Agency	Operating the wastewater treatment plants on daily basis, controlling and evaluating effluent quality.
Dinas Pekerjaan Umum dan Penataan Ruang (DPUPR) Kota English: Public Works and Spatial Planning Agency	Building wastewater treatment plants (infrastructure projects), spatial planning on future area developments.
Dinas Perdagangan Koperasi dan UKM (Dindagkop-UKM) Kota English: Cooperative and SME Trade Agency	Providing information on (export) markets and opportunities, facilitating and aiding batik industries to join trade events.
Forum for Economic Development Employment and Promotion (FEDEP) Kota	Promoting batik as Pekalongan's featured product, acting as government's partner in

Government stakeholders	Role and responsibility regarding batik and/or wastewater
	<p>providing coaching and mentoring to batik industries.</p> <p>FEDEP used to receive annual budget from the Province through Bappeda Kota to execute their program. However, that budget has been stopped or decreased significantly since early 2022 (the new management).</p>
<p>Dinas Pariwisata, Kebudayaan, Kepemudaan dan Olahraga (Dinparbudpora) Kota</p> <p>English: Tourism, Culture, Youth and Sports Agency</p>	<p>Promoting batik as Pekalongan’s featured product with creative economic value, promoting Pekalongan batik identity and history, continuing the preservation of batik as intangible cultural heritage by UNESCO.</p>
<p>Museum Batik</p> <p>English: Batik Museum</p>	<p>Promoting batik as Pekalongan’s heritage and legacy, educating general public through batik practice as entry point to learn about batik, showcasing the history of batik in Pekalongan.</p>
<p>Perusahaan Daerah Air Minum (PDAM)</p>	<p>Supplying raw water to households and business through available water sources.</p> <p>PDAM is state-owned business.</p>
<p>Dinas Komunikasi dan Informatika Kota Pekalongan (Dinkominfo) Kota</p> <p>English: Communication and Information Agency</p>	<p>Broadcasting information and updates through Radio Kota Batik. The radio is quite popular in Pekalongan. Potentially can serve in educating the locals on batik wastewater issue.</p>
<p>Badan Penelitian dan Pengembangan (Balitbang) Kota</p> <p>English: Research and Development Agency</p>	<p>Collaborating with academia, community, business, and government in doing research and development for certain initiatives.</p>

From the information in Table 3, the direct agencies responsible for wastewater fall to Bappeda and DLH. Other agencies look at batik as a business with economic drive and interests.

Non-government stakeholders

With the “Creative Economic City” title, Pekalongan’s batik has been heavily branded locally and internationally to be a product with creative economic value. Therefore, independent communities or groups in Pekalongan are founded based on this economic interest to push initiatives that could promote the batik product further. The table below elaborates on non-governmental organisations that have been and could further contribute to the batik industry in Pekalongan.

Table 4 Roles, functions, and responsibilities of Pekalongan government agencies

Non-government stakeholders	Role and responsibility regarding batik and/or wastewater
PCCF/ Pekalongan Creative City Forum	Facilitating its members (mostly batik industries) to raise concerns to the government (one was about the scarcity and rising price of the cloth raw material), organising workshops/ trainings/ initiative that could benefit the members' batik business, informing market trends and demand to its members.
Pekalongan University	Educating public through Batik Engineering study program, revising the Green Industry Standard for Batik Industry.
ASEPHI / Asosiasi Eksportir dan Produsen Handicraft Indonesia	Facilitating batik industries in marketing their product to international market, providing information on market opportunities, educating and training batik industries' skill to promote and sell, enhancing trade promotions through events and exhibitions. INACRAFT is part of their regular events.
BBKB / Balai Besar Kerajinan dan Batik	Carrying out industrial standardization, optimizing the utilization of industrial technology and industry 4.0, green industry, and handicraft and batik industry services.
KADIN / Kamar Dagang dan Industri Indonesia	Facilitating and connecting batik businesses with their local and international network for export opportunities in other countries.

Part of the non-governmental stakeholders is also the batik industries and businesses. We have developed and continued contact with several batik industries already available from the previous studies. These people have been deemed the local champions, eager to change toward more sustainable water use.

This view is also supported by several government agencies that have noted their active participation in events and community activities. They could potentially be the example and vocal persons in promoting more sustainable water use and treatment to other batik industries.

2 Phase 2: Identification and Selection of Appropriate Solutions and Opportunities

Equipped with several preliminary discussions and more in-depth discussions, together with the stakeholders, we are exploring short-term, small-scale activities on the ground that could be the entry points and catalyst to start a more sustainable batik production. Eventually, the activities aim to prepare other solutions that are potentially coming from the Netherlands, technical and non-technical, to take place in the coming years.

Based on the visits, discussions, and lessons learned by the government agencies in Pekalongan, we identified several factors that affect the wastewater issues and problems in Pekalongan.

Table 5 Factors and entry points

Factors	Entry Points				
	Improve and expand communal wastewater treatment plants	Initiate water reuse for communal wastewater treatment plant	Develop green batik standard and industry	Raise awareness on green batik through a pilot project	Develop green batik market
Untreated wastewater flowed from Kabupaten to Kota	×				
Insufficient wastewater treatment capacity	×	×			
Law enforcement improvement			×		
Demand driven batik production from buyers			×		×
Guarded reaction towards wastewater issue				×	
Unused household wastewater treatment plant	×				
Utilization of communal wastewater treatment plant that has not been maximised	×	×			
Trainings, aid, and assistance to develop market				×	×
Awareness raising through batik education and Batik Museum			×	×	×

Factors	Entry Points				
	Improve and expand communal wastewater treatment plants	Initiate water reuse for communal wastewater treatment plant	Develop green batik standard and industry	Raise awareness on green batik through a pilot project	Develop green batik market
Pekalongan is recognised as skilled batik producer				×	×
Use of natural dye as colouring alternative			×		×
Revision of the Green Industry Standard for Batik Industry			×	×	
Batik awareness program				×	
Annual Batik Day celebration to commemorate and preserve batik				×	×

The five entry points we identified are (1) Improve and expand communal wastewater treatment plants; (2) Initiate water reuse for communal wastewater treatment plant; (3) Develop green batik standard and industry; (4) Raise awareness on green batik through a pilot project; and (5) Develop green batik market.

2.1 Improve and Expand Communal Wastewater Treatment Plants

Batik producers see that the government should provide wastewater treatment facilities. Following this, the DLH is mandated and trying to accommodate the wastewater produced by the batik industries.

DLH is struggling with the existing wastewater capacity that they need to treat: (1) the wastewater from Kabupaten (mainly from batik printing workshops), (2) domestic wastewater merged with batik wastewater (different pollutants and consistency), and (3) the wastewater produced by unused household wastewater treatment plants for batik industries. These are the three existing factors that caused the capacity problem in the treatment plants.

As the Batik Industry is growing and will grow even more in the future, DLH has projected that they will need another water treatment plant. There are currently a total of four wastewater treatment plants in Pekalongan, one of which is not working at the moment (IPAL Pringlangu). They also have a detailed engineering design for the new planned water treatment plant (IPAL Jenggot 2). It is still within their plan to build a dedicated batik wastewater line connected directly to the treatment plants.

Based on these growing issues, DLH seeks to improve their existing process/system and potentially expand the capacity or accelerate the processing time to treat more wastewater for the batik industries.

2.2 Initiate Water Reuse for Communal Wastewater Treatment Plant

Kota Pekalongan sources their water from neighbouring cities and regencies. With future developments of industrial parks and increasing water demand, the city might slowly lose their water sources. Circular water use and proper wastewater treatment process should be explored for the city to be prepared and independent in meeting its water demand.

The batik industry has started to think of ensuring their wastewater is channelled to the communal water treatment plant to be treated. Kauman Batik Village is an excellent example of a batik industry, where their wastewater is connected through pipes to the water treatment plant. The plant operates 24/7 and uses biological processes.

Seeing that the treated water is quite clear, the representative of the Village started to explore the possibility of reusing the treated water into the batik process and circularly using the water to reduce the groundwater intake.

They explored two solutions: a nuclear-powered water treatment plant that could separate the water from the waste and nanobubble technology. However, some people, including DLH, were still unsure about using nuclear technology in Pekalongan due to its disaster and accidental risk. Both explored solutions are quite expensive as well for the Village to invest in. The Village is open to exploring other potential technologies that could ensure the treated water is of good quality to be reused in the batik-making process.

2.3 Develop a Green Batik Standard and Industry

During our meeting with Pekalongan University, we were informed that there was an existing standard issued in 2019 for Green Industry for Batik Industry by the national government. The standard was developed for batik industries to be more competitive in accommodating the green market's demand.

After several years, it was clear that the developed standard was too high for batik producers to follow, and only one batik producer in Indonesia managed to meet the standard.

The miscommunication happened because the standard was not developed through inclusive discussions with batik industries and did not reflect on the day-to-day practices done by the batik industries. As of now, Pekalongan University is leading the revision of the existing standard to make it more realistic for the batik industries to meet.

The revised version needs two more forum group discussions to finalise. In the existing and revised standard, there are management and technical guideline that the batik industries need to follow. They have identified that the management standard would be harder to meet.

On the technical aspects, it is regulated that the wastewater from batik needs to be treated in communal or household water treatment plants. The new standard would also offer economic or business incentives to the batik industries that must meet the standard, which is currently under discussion.

With the incentives, batik industries will be more motivated to adjust their production process and explore potential solutions that could help them meet the production standard. Through technical assistance, the Dutch solution providers could introduce their products and expertise tailored to the industry's needs and further support the industries with implementation in the coming years.

2.4 Raise Awareness of Green Batik through a Pilot Project

Dinperinaker had organised training before and during the pandemic on various topics around batik, but the batik industries showed the most interest if the topic touched production, marketing, or business opportunities. Bappeda also shared the same view, where the batik industries were more enthusiastic to market their products, especially after the pandemic, to revive the batik businesses.

Batik industries want to enter export markets and are willing to adjust their production process if there is a market for a more sustainable product. They have also relayed interest in being provided with workshops and evaluations to reflect on the knowledge. Through understanding the need to be more sustainable and realising the potential global market demand, the Pekalongan batik industry could be equipped with information and a step-by-step process to be certified as a green industry.

Following the previous point on the revised Standard, it could bring new enthusiasm for batik industries to capture future market demand for sustainable or green batik products. Sharing this view, Bappeda has suggested a pilot project, or Green Batik Challenge to map, identify, and invite interested batik industries to participate in workshops and real practices training to produce sustainable batik products.

The Challenge will be a design and production competition following the revised Green Industry Standard. Participating batik industries will need to follow the elements in the Green Industry Standard, i.e. the batik wastewater treatment, sustainable water use/ reuse, energy use, managerial aspect of monitoring and evaluation, marketing, etc. Dutch water treatment and reuse expertise will be a great collaboration area to explore and continue.

The goal of the Challenge is to kick off the green batik industry in Pekalongan and Indonesia. As the most well-known batik producers, Pekalongan batik industries are also being prepared to capture the market demand for sustainable textile products and be known as sustainable producers in the future.

2.5 Develop Green Batik Market

Several projections on customers' behaviour and view of sustainable products were optimistic. Younger customers are more environmentally conscious and will

emphasise sustainable or green products. The batik business is not an exception, thus preparing the batik industry to adapt to global market demands on sustainable, environmentally conscious, and environmentally friendly products should start as soon as possible.

Realising existing and future market, the Ministry of Tourism and Creative Economy is very keen to support the promotion of the Pekalongan batik product. They once requested a brochure or product catalogue to be developed as marketing material, which could not be made ready then.

Guided training could be provided through the Green Batik Challenge by local and international (Dutch) experts to help the batik industries take the next steps to explore the international (green) market and strengthen their market positions.

Positively, the batik industry in Pekalongan is a very flexible, quick-to-adapt industry. Specific export destination countries' regulations and market demand insight could inspire and incentivise the batik industry in Pekalongan to realise how they could answer that demand, what the gaps are, and how to be prepared for the demands to come.

3 Phase 3: Matchmaking and Next Steps

Through understanding the local context and based on the activities we conducted in Phase 1 and Phase 2, we designed two steps of workshop activities on the ground in Pekalongan to determine suitable potential interventions, solutions, and stakeholders.

3.1 Matchmaking Workshop

The first matchmaking step was organised by inviting potential Dutch and Indonesian solutions providers, inspiring sustainable changes, and promoting multi-sectoral collaboration for the batik industry. The goal of this step was to determine what solutions and efforts were possible to be applied within the local context and capacity.

3.1.1 Green Batik Forum

Green Batik Forum was organised jointly by Bappeda Kota Pekalongan and The Water Agency on 14 November 2022 at Batik Museum in Kota Pekalongan. This Forum was set as a starting point to kick off a green batik in Pekalongan. During this Forum, more than sixty people from different organisations attended.

The Forum was opened by the Mayor of Pekalongan, Mr Afzan Arslan Djunaid, and he pressed the importance of starting a greener and more environmentally responsible production, where both the batik community could thrive, and the river environment could get better.

First Session

The first session of the Forum acted as information and inspiration sessions for the participants, especially for the batik communities in Kota Pekalongan and Pekalongan Regency. The session discusses what is considered green batik, what elements and standards could be used, and which stakeholders or businesses have started the sustainability path.



Figure 16 Green Batik Forum in Pekalongan

A total of six speakers from different organisations were invited to talk about various aspects of sustainable batik.

1. Dinperinaker Kota

The head of Dinperinaker, Mr Sri Budi Santoso, shared about the potential, challenges, and direction of the batik business in Pekalongan. He also mentioned several initiatives and commitments from the national and provincial governments to support the batik products.

He shared an interesting point that the Pekalongan batik industry is far bigger than in Jogjakarta. However, the export value from Pekalongan does not reflect the size of its industry compared to Jogjakarta.

We understand that the batik producers from outside Pekalongan made their order in Pekalongan due to its craftsmanship and lower price, then sold the product outside Pekalongan and even overseas.

2. PCCF

One of the key people from Kampoeng Batik Kauman, who is also the chairman of PCCF, Mr Ariefwick, talked about how batik is recognised as one of the intangible cultural heritages by UNESCO. He elaborated on how batik has such an economical and historical value, and thus the recognitions translated into actions in educating the next generations through batik training activities done by Batik Museum.

Furthermore, he mentioned how Kampoeng Batik Kauman has started to look at ways to make their production more sustainable by reusing the already treated water from IPAL Kauman in the production process.

From our observations, Kampoeng Batik Kauman is the only batik community with a centralised batik wastewater system directly linked to wastewater treatment. This is also strengthened by the community's commitment to ensuring that any new batik shops merge their batik wastewater into the existing channel leading to the treatment facility. The area is thus a suitable place to start a pilot project for a more sustainable production process.

3. Batik Kelir

The owner of Batik Kelir, Mr Zahir Widadi, is also a senior lecturer at Pekalongan University, teaching the Batik Technology study major. In Batik Kelir, he perfected the method of using indigo plants as a natural dye colourant for batik.

He claimed that natural dyes such as indigo would not produce wastewater because the used water is reused again and again throughout the batik-making process. Additionally, the indigo colour absorbed in the fabric will get brighter over time and make the batik quality even better.

With the opportunity for a sustainable product to be more preferred by the market in the coming years, we see that using natural dye might be of interest to other batik producers.

4. Pekalongan University

Pekalongan University is revising an existing Green Industry Standard for Batik Industry. Ms Magfiroh is one of the experts leading this process.

During the Forum, she elaborated on the two key indicators that the batik industries need to meet in order to obtain the standard: (1) technical requirement, which elaborates how each raw material is used and measured, and (2) managerial requirement that targeted processing and monitoring activities.

This standard will offer incentives for the batik industry to start transitioning into green initiatives, including more accessible access to the international market and marketing opportunities (still under consideration).

In our observations, the batik industries in Pekalongan would need step-by-step guidance and training to start the transition. The components in the Green Standard would need to be translated into a more practical process that can be followed, then tested by the industries, and evaluated gradually.

5. Bell Society

To inspire the local batik communities on the possibilities for sustainable business, we invited an Indonesian brand, named Bell Society, which Mr Arka Irfani and Ms Semeru Gita founded.

Bell Society focuses on creating synthetic leather-like material that could be used for apparel products, such as wallets, shoes, belts, etc. Their sustainability value comes from using coffee waste as their primary source of material. Within their production process, their product is also using less water and energy.

They inspired the batik community on how they started the brand, what challenges they faced, and how positively the market responded toward a sustainable product, which proves that sustainability could be profitable for business.

6. Blue Deal

A total of 4 people from the Blue Deal team visited Pekalongan at our invitation to see the possibilities of how the wastewater treatment process and infrastructure could be improved.

In their presentation, they showed the participants different water management systems that exist in the Netherlands as an inspiration that a localised context could be put into practice for Pekalongan.

The Forum served as an important first step for them to be familiar with the local issues, context, and stakeholders, as well as to build relationships between the local stakeholders and the Blue Deal team.

Second Session

The second session of the Forum was an active brainstorming session where participants were given a set of keywords that led to sustainability options and were encouraged to provide their input on what could be done with those options. The inputs resulting from the Forum would then be discussed with key stakeholders as the potential follow-up agenda.



Figure 17 The result of brainstorming session

The Forum also served as a networking opportunity for the participants to get to know the latest developments in the batik industries. In parallel to that, the Forum was also a suitable ground for the Blue Deal team to be introduced to the local stakeholders and become familiar with the context.

3.1.2 Wastewater Treatment Technical Assessment

After the Green Batik Forum activity, we organised a 3-day site visit for the Blue Deal experts, the Dutch Water Boards (Water Board Noorderkwartier and Water Board Zuiderzeeland), to several wastewater treatment plants (WWTP) across the city. The site visit aimed to assess WWTP's condition in Pekalongan and identify what kind of support from the Blue Deal experts might improve the WWTP.

Site Visit – 15 November

We visited four different locations on the first day of the site visit. The first location is a famous batik shop in Pesindon Village called Batik Larissa. Batik Larissa is one of the village's batik shops that was provided by individual WWTP by DLH back in 2010-2015. We visited Batik Larissa to check the condition of the individual WWTP.



Figure 18 Individual WWTP in Batik Larissa

From the site visit, it was found that the individual WWTP has not been used anymore. After the installation of the individual WWTP, there was only one visit from the DLH to check and monitor the WWTP, which was already a long time ago. Since then, there has never been another evaluation or cleaning of the WWTP from the DLH.

Furthermore, there has never been any training or knowledge exchange for the batik shop owner regarding the operation or technicalities of the individual WWTP. Consequently, none of the batik shop owners understands how to operate the WWTP nor how to maintain or manage it.

The second location we visited was the communal WWTP in Kauman Village. Instead of using individual WWTP, Kauman Village has one communal WWTP for the whole batik workshops in the village. Every batik workshop in the village has built a pipe that connects their batik waste into one big WWTP.



Figure 19 Kauman Communal WWTP (left), the batik wastewater (middle), the discharge water from the WWTP (left)

The Kauman communal WWTP uses mainly electricity to operate and is in good condition; the wastewater discharge was also quite good. The discharged water has a good potential to be reused for the batik industry or even drinking water by combining it with the water from PDAM or rainwater harvesting. In general, the Kauman communal WWTP already has good management and conditions.



Figure 20 Griya Mas Batik Workshop

Near the Kauman communal WWTP, there is also a batik workshop by one of the batik shops in the village called Batik Griya Mas. Together with the Blue Deal team, we were able to see the local people do the traditional process of batik from beginning to end, one of the Indonesian cultures that must be preserved.



Figure 21 Batik Kelir Workshop use natural blue dye (indigo colour)

The site visit was closed with a visit to the Batik Kelir workshop, a batik workshop that used natural dye for batik colouring. The owner, Zahir Widadi, used the *Indigofera* leaves to create an indigo colour as the natural blue dye. Zahir also claimed that the natural dye does not produce waste, as it will not be disposed of but continuously be reused. Zahir is in the process of exploring other potential natural colouring and would happily share his expertise in this area.

Site Visit – 16 November

On the second day, we arranged a site visit to four locations. The first location is PDAM Tirta Kajen in Kabupaten Pekalongan. Currently, some of the areas in Kota and Kabupaten are using Pamsimas (Program Penyediaan Air Minum dan Sanitasi Berbasis Masyarakat/ Community Based Water Supply and Sanitation Program) as the water source. Pamsimas is cheaper than PDAM; thus, most of the community prefers to use it. However, PDAM stated there would be a regulation change where Pamsimas would not be allowed to be used anymore. All villages must use PDAM as their water source except the area without access to PDAM.



Figure 22 Meeting with PDAM (right) and PDAM Water Source (left)

Currently, Pamsimas and PDAM use groundwater as their water source. However, looking at the situation in Pekalongan, where the land subsidence and coastal flooding are worsening, PDAM planned to close their groundwater well and use the river as their water source.

The second location we visited was one of the communal WWTPs in Kabupaten Pekalongan called Simbang Kulon. The WWTP Simbang Kulon was built to manage wastewater from the Kabupaten area. However, the design and construction is imprecise, as the WWTP location is in the upstream area, while most of the batik shops and workshops are located in the downstream area.

As a result, they need a pump to channel the wastewater into the WWTP Simbang Kulon to be treated, and unfortunately, the pump is broken and not working. Temporarily, the WWTP is being used to process batik printing and jean-washing waste from the upstream area. Yet, when we visited, the WWTP was not used anymore.



Figure 23 Unused Simbang Kulon WWTP makes river contaminated by wastewater

Next visit was to the WWTP Jenggol in Kota Pekalongan. Different from WWTP Kauman, which used electricity, WWTP Jenggol used constructed wetlands to treat the wastewater. So far, the discharged water from WWTP Jenggol has the best results as it uses natural components. The only issue is the capacity. It is estimated that the capacity in WWTP Jenggol is only half of the original, around 20-40%, and the rest flows directly to the river. This is due to a lack of maintenance and monitoring.



Figure 24 Constructed wetlands in WWTP Jenggol

There is a plan for the second WWTP Jenggot that is located just across the existing one to be able to cover all the wastewater in the area. Yet, if the existing WWTP Jenggot can be repaired and improved to increase the capacity, then the second WWTP Jenggot might not be needed.

The last location to visit was one of the batik shops in Kauman Village called Batik Megas owned by Mr Wiwit. As one of the batik figures in Pekalongan, he is very interested and keen in sustainable batik, especially from the water use point of view. Mr Wiwit and the Kauman Village community would be really happy and supportive if there were an initiative to reuse the wastewater to reduce groundwater use, as the process of making batik usually requires a lot of water.

Mr Wiwit and Kauman Village community also want to preserve written and stamped batik as the true identity of batik. They realise that some parts of the batik-making process are harming the environment, and they are already aware that there are more environmentally friendly ways to do it. Thus, we believe that people like Mr Wiwit could be the local champion to start a small-scale activity to achieve green or sustainable batik in Pekalongan.

3.1.3 Scoping of Potential Green Batik Pilot Project

After the visits and discussion with a potential local champion, on 17 November, we organised an internal meeting with Bappeda and DLH Kota Pekalongan to plan for the next steps. Results from the Green Batik Forum discussion were presented, which aligned well with the initiatives that Bappeda had in mind.

The meeting discussed a potential location for a pilot project, which was planned to be Kampoeng Batik Kauman, as the existing infrastructure and local awareness had already been in place, followed by strong support from the batik community itself.

Additionally, BBKB in Jogjakarta had expressed support for working with batik shops in Pekalongan to be more sustainable/ green. Given this support, we see the potential for BBKB and KADIN to help export the green batik to the international market. In the pilot projects, opportunities to test and implement ranges of solutions are as below, but not limited to:

1. Improve IPAL Kauman process

Kauman wastewater treatment plant is only treating batik wastewater that is coming from batik workshops around the area. The treatment process uses a biological process with bacteria but previously adopted a mix of chemical and biological processes. The change in how they process sludge production caused the wastewater as the residue, which was considered a hazardous material and needed to be dumped properly. The dumping of this material required complex collaboration with the ESDM Agency.

The treated wastewater quality was checked briefly by the Blue Deal team. It resulted in moderate quality, sufficient enough to be reused for batik production but remaining untested in the batik-making process.

It was agreed that the Blue Deal team would assess the capacity and process of this IPAL and advise on changes to improve the process if needed.

2. Reduce water footprint through other potential water sources

Most batik industries in Pekalongan use two water sources: (1) PAMSIMAS and (2) private wells. Starting in November 2022, there is a regulation to phase out groundwater use in Kota Pekalongan, meaning if PDAM has a supply line in a certain area, that area is required to use PDAM and not PAMSIMAS or their private wells.

PAMSIMAS was encouraged to accelerate community-owned and operated water sources and sanitation systems with little support from the government. The fee for the operation and maintenance of the system is divided equally among the community.

On the other hand, private wells are also dug freely around the city, with depths unknown. Private wells are not controlled and require only the initial investment for the pump. Metered water pumped from the ground is not measured and is free of charge.

Compared to PDAM water, the options of PAMSIMAS and private wells are far cheaper for the batik industries. Through the visit, we explored the possibilities of reusing treated wastewater in the process of batik-making and using harvested rainwater around the village for the Pilot Project.

3. Implement Green Batik Standard

The practical step-by-step formulation of the components inside the Green Industry Standard would be needed and was also requested by batik industries.

Given how the standard had been well developed in the formulated Pilot Project, training to follow the Green Standard would be a possibility to educate, raise awareness, and push the batik workshops to be certified as Green Industry, which is also the national government agenda.

Support, commitment, and incentives from the Ministry level would boost the commitment from Pekalongan batik industries to start the sustainability path.

4. Create batik working group on Kota level

The wastewater from the batik industries impacts the rivers' health in Pekalongan and has become a significant problem for the people in Pekalongan. However, given each governmental agency's different tasks and roles, they have limitations in addressing the very broad water quality issue.

The Blue Deal team proposed to create a working group consisting of stakeholders from government and non-governmental organisations, including representatives of the batik industries, that would promote a more targeted yet interdisciplinary approach to solving wastewater issues.

Through the working group, various stakeholders with different tasks and roles can focus on the wastewater issue, address the issue in an integrated way and from many lenses, and formulate a plan that can be executed in their capacities.

5. Test innovative production technologies

Exploration and combination of a more natural dye such as indigo colour could bring dual benefits: (1) less wastewater generated because the wastewater could be used again in the colouring process; and (2) a unique product with locally sourced natural colourant that promotes sustainable textile.

With the right promotion, this way of producing batik would generate a unique market position and trigger more innovation on the ground. In the natural dye sector, an institute in Jogjakarta called INDI UGM has started exploring more natural colour sources unique to different parts of Indonesia.

6. Establish “Green Batik” label brand for Pekalongan

Based on our discussions with shop owners in Jogjakarta, customers and tourists have become more aware of sustainability issues. They would ask about the source and the production process of a product. A new branding such as “Green Batik” could open a unique market opportunity for batik products that have been produced in an environmentally friendly process.

Pekalongan is also well-known as the capital city of batik. With the branding of “Green Batik”, it would be known further as the first city in Indonesia that have sustainable and responsible production of textile batik product. City branding as such can be used to attract other tourism activities in Pekalongan and promote other unique products from Pekalongan as well.

7. Introduce other potential Dutch wastewater solutions

The Pilot Project will be fertile ground to test innovation on the ground and see which ones suit the needs driven by the local batik industries. With the understanding and opportunities for a more sustainable batik production, the Pilot Project will focus on Kampoeng Batik Kauman, with the potential to be scaled city-wide.

3.2 Kauman Green Batik Village Pilot Project

Following our regular interactions with the batik villages, observations, analysis, and suggestions from related stakeholders, we are looking first to launch the Pilot Project in Kampoeng Batik Kauman (Kauman Batik Village). This unique batik village has a tight community value and suitable supporting infrastructures to become more sustainable.

Kampoeng Batik Kauman is located in the Kauman sub-district, East Pekalongan District. The village is well-known as a centre for batik craftsmanship and was designated as a batik village in 2007 by the then Indonesian Vice President, Jusuf Kalla. Since being given the title, Kampoeng Batik Kauman has grown into a closer community and further reinvented itself as a tourism attraction.

The village has narrow alleyways with unique community walls that show how batik culture is imprinted as their identity. At the end of the alleyway, one WWTP was built in 2008, especially for batik wastewater. Pipelines connect every single batik workshop in this village to the WWTP for centralised wastewater treatment.

Currently, there are forty-one batik shops in the village; twelve of those have their own workshops to produce batik in-house, and some are open to the public. Opening their doors to the public is intended to educate the younger generation and potential buyers about the art of batik.



Figure 25 Kauman workshop showcases their batik process

The Pilot Project is planned in Kampoeng Batik Kauman as the starting point. The batik community here has started to see the importance of being more sustainable for their environment, especially those attending regular market exhibitions in bigger cities.

The Kampoeng Batik Kauman community also wished to reuse the treated wastewater in the batik production process. They have come to realise that several steps of producing batik could be improved, and awareness has started to grow.

However, they need to be supported through practical guidance and facilitation to exhibit promising results. A pilot project in this village is a suitable testing ground to raise awareness and would set an example for other batik industries to become more sustainable in their water use.

3.2.1 Pilot Project Workshop

A second workshop was organised with the Kauman community in early February 2023, specifically with those who are part of the Paguyuban Kampoeng Batik Kauman. During the workshop, the Paguyuban expressed their interest in making Kampoeng Batik Kauman a flourishing community with measures that bring positive added values to the whole village.

In Kauman itself, their biggest market exists within Indonesia. Most of their customers are based in Jakarta, Jogjakarta, and Solo. These regions make up to 80% of their sales. Given the stable revenue stream from outside Pekalongan, many of these shops do not open physical stores to accommodate visitors.

In 2018, the Paguyuban launched an initiative to facilitate several batik shops in showcasing their product in a dedicated shared/ community space called Oemah

Kreatif Kauman. The Paguyuban members handled the daily operation with a small amount charged to the batik shop owners. When Covid-19 happened, they closed the space due to the regulation and slowing market. After this workshop, we list potential interventions that could be applied to the batik-making process.



Figure 26 Workshop with Kampoeng Batik Kauman

Batik Process

The workshop with Kampoeng Batik Kauman's community resulted in a generous amount of input and feedback for the Pilot Project. We aim to first understand the batik process before identifying a suitable intervention for achieving green batik. As explained and shown by several batik workshops, there are five main steps of the batik process.

1. Designing

The first step of creating a batik is to design the pattern or the concept of the batik. The most common one is to prepare the big picture on a piece of paper and then move the design to the cloth by tracing the lines and shapes. We also observed several designers directly start drawing on cloth.

2. *Mencanting* and Stamping

When the design is already copied to the cloth, the next step is to cover the design with the wax using *canting*, a traditional pen-like tool to draw batik patterns and create handwritten batik. The other way to create a batik pattern is by using a stamp that is already pre-made, which is then called a batik stamp. In some designs, the batik makers might mix both techniques of *canting* and stamping to create mixed patterns of batik.



Figure 27 Mencanting (left), Stamping (Right)

3. Dying / Colouring

The next important step is colouring. Roughly, the batik producer mixes two buckets of water and four cups of dye to colour 3-4 cloths in a colouring container. They dip the cloths several times depending on the desired colour; the stronger colour they want, the more times they dip the cloth into the container. Currently, almost all batik producers in Pekalongan use imported dye from China, India, and Germany. Cost plays an important part in determining which imported dye is used.

4. Melorot

After the cloth is coloured, it is then dipped into a container of boiling water to dissolve the wax; this process is called *melorot*. There will be two containers of boiling water, and the cloths will be dipped several times into those two other containers to ensure the wax is shed thoroughly. Following that, the cloth will be put into cold water and washed two times in two different containers with running clean water to ensure the cloth is clean before it is air-dried.



Figure 28 Melorot (left), Washed with running water (right)

5. Drying

Once the cloth is washed with clean water, the last step is to dry the cloth naturally. Depending on how they are made and the colour-binding ingredients used, certain cloths cannot be exposed to direct sunlight as it will affect the batik colour; thus,

they should be dried carefully. Step (2) to step (5) are repeated numerous times to achieve the batik desired batik design and colour combination.

3.2.2 Pilot Project Plan

Green batik is not necessarily a new type of batik, but it is a batik (handwritten, stamped, or mixed combination) that follows/ undergoes a more sustainable production process.

Kauman Green Batik Village is a pilot project aimed at achieving a green batik village by providing and guiding the Kampoeng Batik Kauman through several suitable interventions in the batik process and post-batik process. This pilot would bring positive impact to the water body and environment for more than 800 batik industry workers in Kauman.

Adapting from five identified entry points in Phase 2, the four main objectives of the Pilot Project are: (1) Improve the water management in the batik process, (2) Adapt the Green Batik Standard into the batik process, (3) Identify and develop green batik market (local and international), and (4) Promote green batik process in other Pekalongan villages.

The first two objectives will focus on intervention in the batik process, while the last two objectives will focus on intervention in the post-batik process. All interventions are planned to last for about two years and are divided into four phases in which dedicated practical training sessions will need to be carried out and budgeted. When the Pilot Project is completed, it is expected that several batik industries in Kampoeng Batik Kauman will be able to produce and market their green batik product independently and become the first Green Batik Village in Indonesia.

Batik Process Interventions

Based on the workshop with Kampoeng Batik Kauman's community, it was explained that there are five steps in the batik process. Added with input from Phase 2 analysis and matchmaking workshop, some suitable interventions are identified as follows. These interventions will take place on some steps of the batik process, which can improve water management as well as meet the requirement of the Green Batik Standard.

1. The use of natural or environmentally friendly dyes to reduce hazardous substances in wastewater discharge

As Pekalongan is located in the coastal area, Batik Pekalongan is called Batik Pesisir (Coastal Batik), which is famous for its various bright colour. Hence, Batik Pekalongan used a lot more colours than batik from different areas, which usually only used 2-3 colours. As most of the Kauman batik producers use imported dye, the amount of dye they use depends on the quality of the imported dye. The better the quality of the dye, the less dye they will need to use. Cost is the main driver in determining which type of dyes they will use.

For that reason, to produce green batik in the Pilot Project, the batik producer in Kauman will be encouraged to select/ develop the dye with the best quality and, certainly, the environmentally friendly one to reduce the amount of hazardous substances on the wastewater. Consequently, it will reduce the wastewater treatment processing time in the WWTP. This is connected to point (5) below.

2. The use of biogas as a more sustainable energy

In step four of the batik process, which is melorot, the producers need continuous fire to boil the water that is used to shed the wax from the cloth. They start the fire first thing on the day and turn it off last.

Currently, they use firewood to produce heat; it is deemed by their experience that firewood retains heat best and for a longer duration. Additionally, it is cheaper than other energy sources, such as gas. This is important to melt the wax continuously and quickly to prevent delaying the other repetitive process.

For canting and stamp processes, they use gas as they need steadier low heat to melt the wax. Gas cylinder setup requires only a small space; hence it is more suitable for this process.

To reduce the use of firewood and gas, we propose finding another alternative to create fire heat, such as biogas. Biogas needs organic material (possible through domestic waste) as fuel instead of wood. Thus, it will not only reduce the cost of buying wood and gas but also reduce the amount of organic waste.

One local person in Kauman has developed a biogas infrastructure for everyday use in their home. It is possible to be replicated with further testing.

3. Reuse of the batik wax/ *malam* to reduce hazardous substances in wastewater discharge

When the wax is being shed from the cloth in the melorot process, the melted wax will be deposited in the bottom of the boiled water container. Instead of being thrown and mixed with the wastewater, the melted wax can be retrieved back for reuse. The deposited wax will be mixed with the new wax and other additives, which will later be used for the mencanting and stamping process. This is quite a common practice for the batik industry; however, the processes can still be improved further to maximise wax reuse. Doing so will lighten the WWTP performance in terms of treatment load and duration.

4. Collect and use rainwater to reduce groundwater extraction

The batik process uses a lot of water, especially in the melorot process, where the cloth needs to be boiled to remove wax and then washed two times in two different water basins. The first water basin uses running clean water to ensure the cloth is clean before it is dried, followed by another more prolonged dip in the next water basin. The batik producers changed the water on the second basin as needed, with clarity being their indicator.

Along with the other batik processes that use water, this process utilises groundwater as the primary water resource. In the Green Batik Village Pilot Project, the batik producer will be encouraged and equipped with tools to utilise rainwater for the batik

process. Thus, it will reduce groundwater use, subsequently slowing down the land subsidence rate in Pekalongan.

5. Reuse of treated wastewater to reduce groundwater extraction

As mentioned, Kampoeng Batik Kauman has a communal wastewater treatment plant to treat batik wastewater in the village. The treated wastewater quality was previously checked with a simple testing tool by the Blue Deal team. It resulted in moderate quality, which means it is highly possible to be reused for batik production.

As several steps require water in the batik process, a further test is needed in the Pilot Project to determine which step can utilise water from treated wastewater. Reusing the treated wastewater could reduce groundwater use as well as increase water efficiency. Infrastructure work will be needed to construct the pipeline from WWTP to the individual workshops.

6. Use of surface water from PDAM to reduce groundwater extraction

PDAM has built another upstream intake to accommodate the growing raw water demand for households and industries. Currently, two hotels and one fast-food chain restaurant are planned to be built in the next few years. In parallel, PDAM is also gradually reducing its dependency on groundwater and slowly closing eight deep wells; this was mandated through government regulation. In Kampoeng Batik Kauman, a water network from PDAM has been developed for household use. For it to be used as one of the main water sources for batik production, the pipe size needs to be increased to flow more water. Water meters are to be installed to measure water use, and fees are charged to maintain the operation costs.

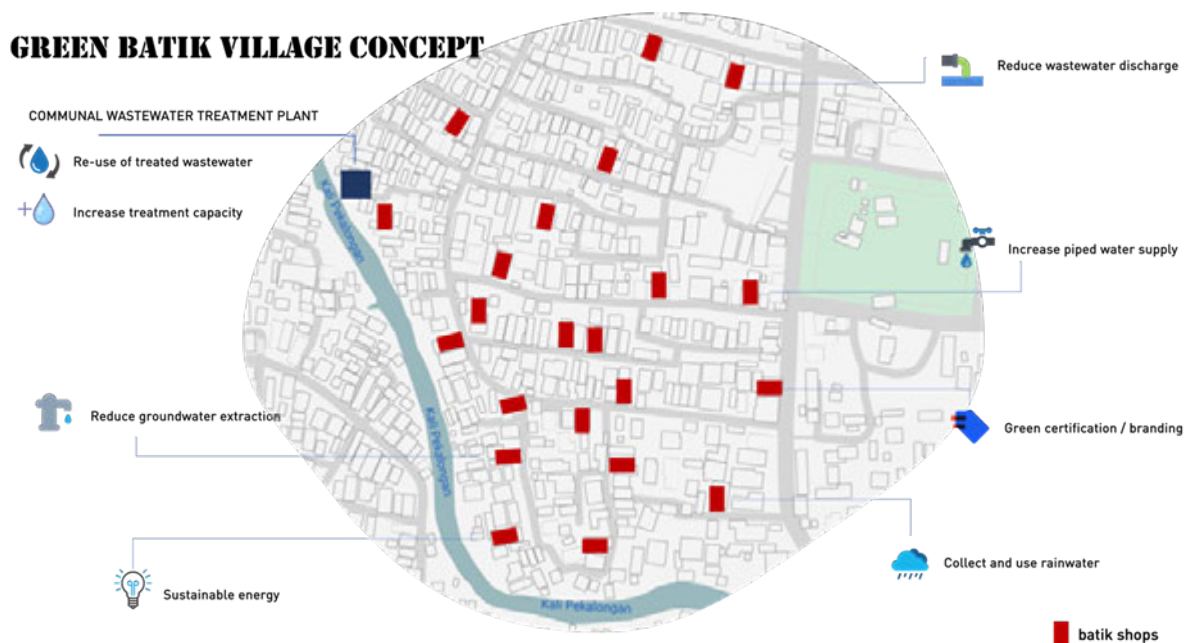


Figure 29 Green Batik Village concept

Post-Batik Process Interventions

In line with the production of green batik, it is crucial also to identify the green batik market and how to promote it, as one of the challenges in developing green batik is to compete with the existing batik product and printed batik motives products.

Communication and awareness are the keys to creating product differentiation and market segmentation. Hence, following the workshops and analysis, some post-batik process interventions are identified to support the sustainable green batik business.

1. Organise networking events with local and international market

A networking event encourages engagement between people in the batik industry to build valuable and professional connections, introduce initiatives, and raise awareness. The actors include batik designers, producers, buyers, and enthusiasts.

A networking event is a great way to meet these new people in the batik industry and develop new contacts. It helps to identify and assess interests, then to develop a list of potential buyers and market for green batik. A strong network in the batik industry would improve the value of batik in general and create a space for a new product: green batik.

2. Develop batik tourism as a part of marketing green batik

Tourism is one of the strategic ways to boost green batik exposure and revive the local economy. A series of batik tours could be created by utilising the current batik facility and attractions in Pekalongan, such as Museum Batik, other kampoeng batik, and batik workshops.

As Kampoeng Batik Kauman is one of the most famous kampoeng batik in Pekalongan, it could be fertile ground to introduce the green batik concept, including the idea behind it, the process, and the end product.

3. Develop digital tools to promote and inform green batik concept

In this digital era, where technology and the internet are taking over how we communicate and spread information, developing digital tools for promotion and publication is crucial. Developing a digital platform for green batik makes people just one click away from receiving needed information about green batik and even buying them.

A digital platform aims to disseminate information, create exposure for the latest green batik development, and develop more accessible access to the digital market. It also increases the opportunity to inspire other kampoeng batik inside and outside Pekalongan on the possibilities for green batik.

4. Organise a green batik exhibition to introduce green batik product

Another way to promote and market green batik is to organise an exhibition where people from the batik industry and other industries, local and international, are invited to see the product and understand its story and cultural value. This goes hand in hand with or independently from point (1) above.

The exhibition could act as a sandbox that sparks and generates more ideas for possible development and improvement. The exhibition could be done solo or as a collaboration with existing exhibitions such as INACRAFT, one of Indonesia's biggest art and craft exhibitions.

5. Create a green batik label to differentiate from the other batik product

There are three types of batik, such as handwritten batik, stamped batik, and a mixed combination of both. Printed batik motives are not considered batik, but the motives' appearance, the strong claim by producers, and low awareness of the product made the printed motives considered batik by many people.

Previously, several batik communities in Pekalongan had the initiative to create batik labels to differentiate batik with printed batik motives, as there are a lot of buyers who would need help to see the difference between the two.

Learning from that, a specific label for green batik should also be made available and acknowledged to differentiate between green and non-green batik products. This aims to inform the buyers, raise awareness, and create unique market value for green batik. Of course, this needs to go in parallel with raising awareness and educating potential buyers.

Pilot Project Timeline

The Pilot Project contains a series of activities to achieve a Green Batik Village, such as database analysis, practical training, intervention planning and implementation, market development, and scale-up. We envision the Pilot Project to be executed within two years. In order to set clear priorities and directions, the two years timeline is divided into four phases as follows.



Figure 30 Pilot Project Timeline

Phase 1 – Preparation

Further analysis in Kampoeng Batik Kauman is needed to conduct targeted and effective interventions. The analysis aims to identify the current green level of batik workshops in Kampoeng Batik Kauman, as some of the workshops may already implement one or two green batik processes planned as green interventions. Thus, collecting a database of each workshop could identify the zero point of this project.

Some necessary infrastructure and intervention materials needed for the batik process and post-process intervention should also be identified, prepared, and built in Phase 1, as there might be some required permanent or temporary constructions for the intervention. Any mandatory formal or informal permits and paperwork should also be completed in this phase to ensure the smooth running of the Pilot Project.

Phase 2 – Practical Training and Market Development

When most of the preparation in Phase 1 is completed, some activities in Phase 2 can be started concurrently. Before starting the project intervention, several practical pieces of training are necessary to familiarise everyone with the Pilot Project concept, its goals, and activities leading to achieving Green Batik Village.

In addition, market development should be started as early as possible to ensure the market is ready and well-developed for green batik, locally and internationally. Activity related to market development can be conducted during this phase to secure the confidence of the Kampong Batik Kauman community about green batik.

Phase 3 – Project Intervention

Project intervention is the phase where creativity and adjustment are developed through trial and error. Here, the batik producer in Kampong Batik Kauman will work together with related stakeholders to produce green batik products in accordance with the Green Batik Standard regulated by the government. The community will be guided and provided with needed assistance from the beginning until the end of the green batik process.

Phase 4 – Promotion and Scale-up

As the green batik product is ready, the next step is to promote and market the product using various ways and platforms, including offline events such as exhibitions or batik tourism tours where the batik producer in Kampong Batik Kauman will open their green workshop to the public, and develop a digital platform to promote and disseminate information about green batik village. The potential and possibility to replicate the interventions as a scale-up project in other workshops/ places will be evaluated within this stage with relevant stakeholders.

Below is the summary of activities and interventions under each phase. The duration of each phase is estimated based on the information gathered and activities conducted for this report. The stakeholders involved in the Pilot Project are not limited to the stated ones. A dedicated, multi-stakeholder team is needed to execute the Pilot Project.

Table 6 Project phasing, interventions, and involved stakeholders

Phases	Activities/ Interventions	Duration	Stakeholders
Phase 1 – Preparation	<ul style="list-style-type: none"> • Green component assessment • Green level database 	4 months	<ul style="list-style-type: none"> ○ Kampoeng Batik Kauman ○ Bappeda ○ DLH ○ Dinperinaker ○ Dindagkop-UKM ○ Pekalongan University
Phase 2 – Practical Training and Market Development	<ul style="list-style-type: none"> • Environmentally friendly dyes • Biogas energy • Wax reuse • Rainwater harvesting • Treated wastewater reuse • Surface water from PDAM 	6-8 months	<ul style="list-style-type: none"> ○ Kampoeng Batik Kauman ○ Bappeda ○ DLH ○ Dinperinaker ○ DPUPR ○ Dinas ESDM ○ Pekalongan University ○ Blue Deal/ Dutch water solution providers ○ PDAM ○ Telkom Pekalongan
Phase 3 – Project Intervention	<ul style="list-style-type: none"> • Market networking event • Green batik tourism • Digital marketplace and tools • Green batik exhibition • Green batik label/certification 	3-4 months	<ul style="list-style-type: none"> ○ Kampoeng Batik Kauman ○ Bappeda ○ Dinperinaker ○ Dindagkop-UKM ○ Dinparbudpora ○ KADIN ○ National galleries/ Museum Batik ○ BBKB ○ INACRAFT
Phase 4 – Promotion and Scale-up	<ul style="list-style-type: none"> • Evaluation, improvement, and replication of Phase 2 and Phase 3 	6-8 months	<ul style="list-style-type: none"> ○ Kampoeng Batik Kauman ○ Bappeda ○ DLH ○ Dinperinaker ○ Dindagkop-UKM ○ Dinparbudpora ○ DPUPR ○ Dinas ESDM ○ Pekalongan University ○ Blue Deal/ Dutch water solution providers ○ PDAM ○ Telkom Pekalongan ○ KADIN ○ National galleries/ Museum Batik ○ BBKB ○ INACRAFT

Budget Plan

Interventions in the batik and post-batik process are budgeted as follows. The budget is based on rough estimates of material costs, construction and non-construction works in Indonesia. The estimated numbers are subject to change when a more detailed plan and survey are conducted.

Interventions

<i>Process</i>	<i>Item(s)</i>		<i>Cost</i>
Throughout Process	Training for green batik standard element	EUR	5,200
Batik Process Interventions 1	Environmentally friendly dyes	EUR	2,250
Batik Process Interventions 2	Biogas energy	EUR	3,500
Batik Process Interventions 3	Wax reuse	EUR	325
Batik Process Interventions 4	Rainwater harvesting	EUR	3,750
Batik Process Interventions 5	Treated wastewater reuse	EUR	6,750
Batik Process Interventions 6	Alternative raw water source	EUR	8,250
Post-Batik Process Interventions 1, 3, 4	Green batik market development (incl. networking, digital tools, and exhibition)	EUR	5,500
Post-Batik Process Interventions 2	Green batik tourism	EUR	875
Post-Batik Process Interventions 5	Green batik certification	EUR	13,600
Sub-total		EUR	50,000

Project management

<i>Process</i>	<i>Staff(s)</i>		<i>Cost</i>
Throughout Process	Project manager (1 person) / 48 days	EUR	24,480
Throughout Process	Local liaison (1 person) / 144 days	EUR	45,360
Throughout Process	Local project staff (4 people) / 768 days	EUR	119,040
Throughout Process	Technical expert (8 people)/ 64 days	EUR	61,120
Sub-total		EUR	250,000

Total (in EUR)

EUR 300,000

Project Success

The Pilot Project looks at a mix of stakeholders to be involved and engaged to succeed. Local interest and support will transform the batik industries to be more sustainable.

Based on previous engagements and field visits, Kampong Batik Kauman is the most suitable batik community to be engaged further, as the existing infrastructure and local awareness had already been in place. The engagement should be followed by strong support from several key stakeholders, such as government agencies, businesses, to universities.

Participatory and inclusive engagement always needs to be the primary approach. Constant and regular on-the-ground activities need to be organised continuously by someone trusted by the key stakeholders to ensure commitment and to motivate the efforts.

3.3 Conclusion

Based on the visits, discussions, and meetings up to February 2023, the batik industries have yet to see a direct need for technological intervention at this phase. The batik industries in Pekalongan have just restarted their batik business post-pandemic and are slowly recovering. Their primary interest still lies in market demand and opportunities. Addressing the wastewater issue without looking at other socio-economic factors that could incentivise the industries to change would have a short-lived impact.

The Green Batik Forum held on 14 November 2022 brought more than sixty people together from the batik communities, artists, government agencies, and non-governmental organisations. Through the Forum, these stakeholders learned, were inspired, and discussed sustainability options.

The Forum provided good inputs from different lenses and showed readiness by Kampoeng Batik Kauman to be a pilot project location. Kampoeng Batik Kauman is home to around forty batik industries that produce batik in the traditional way. This community has started to seek more sustainable practices by bringing out the idea of reusing treated wastewater.

Further workshop held with the Paguyuban has validated the previous findings. During the workshop, the Paguyuban agreed and wished to be supported and guided for more sustainable practices they could adopt. However, important points such as ensuring market position and building customers are repeatedly discussed and should not be taken lightly.

Similar remark was also mentioned by other stakeholders we visited in February 2023. Bappeda and other stakeholders in Pekalongan are supportive for a continuation of the project into a Pilot Project and to see positive changes for the batik industries in Pekalongan. These stakeholders wish for concrete actions on the ground and would commit to providing continuous support.

Kauman Green Batik Village Pilot Project could be a suitable testing ground and inspiration for other Pekalongan batik industries to become more sustainable in their water use.

For the local community in Kauman and stakeholders in Pekalongan, seeing is believing. In the future, part of the batik process will need to change to ensure they can still produce batik and uphold its cultural and historical value while maintaining a habitable environment for future generations. Green batik is it.

Annex I

Project Workflow

The Dutch government is strongly committed to supporting the city of Pekalongan to develop more sustainable and healthy management of water resources to benefit all people. The Batik industry in Pekalongan is one of the focus areas as it causes significant overexploitation and pollution of water. Based on recent studies into the water challenges related to the Pekalongan batik industry, the Pekalongan government and the Dutch government have agreed to explore the potential of Dutch water (technology) solutions to address the Batik wastewater problems.

The project is divided into three phases that continue from one to another. Phase 1 focuses on understanding what is seen as the issue, mapping and further identifying stakeholders within the project, and determining the local requirement for matchmaking while exploring opportunities for possible solutions.

Phase 2 then dives into identifying and selecting the appropriate solutions based on the expectations of local stakeholders. With a strong foundation on identified gaps from the expectation, matchmaking is then done during Phase 3.

The workflow (as shown in Figure 31) is to set up a strong foundation of working relationships, especially targeted on the beneficiary, i.e., the government agencies of Indonesia and the local batik industries. This foundation is to prepare for other solutions – technical (hard), socio-economic (soft), or institutional (policy, regulation, capacity building) – on upstream or downstream approaches on a communal or individual-scale, to be well-received and suit the needs of Pekalongan batik industries and people.

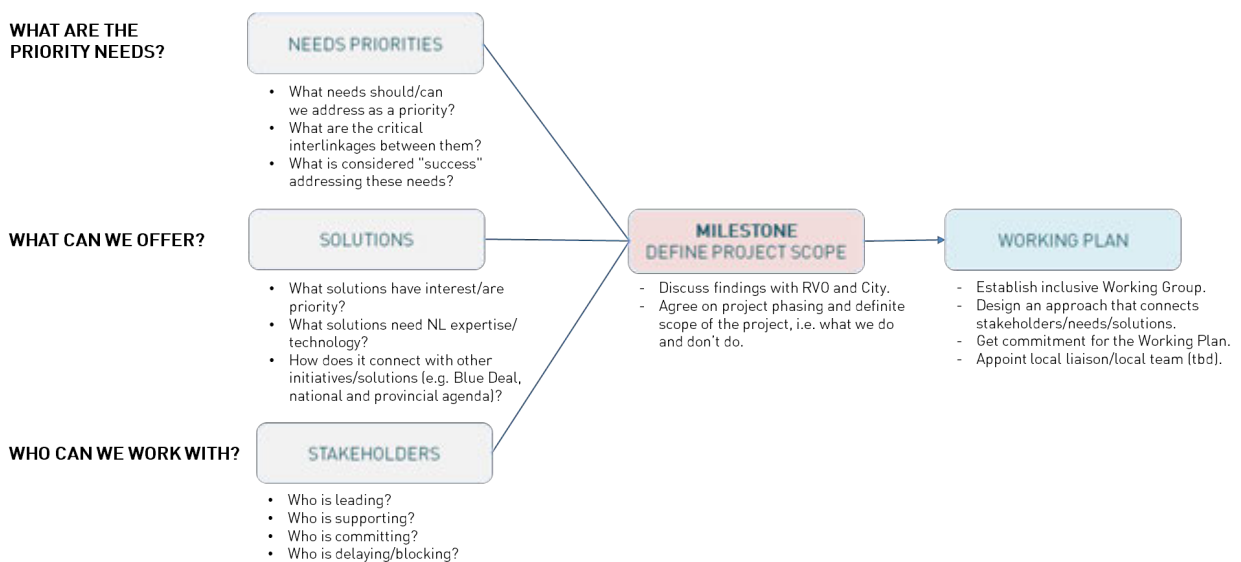


Figure 31 Batik wastewater workflow

Annex II

Attendance List & Presentation at the Green Batik Forum

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