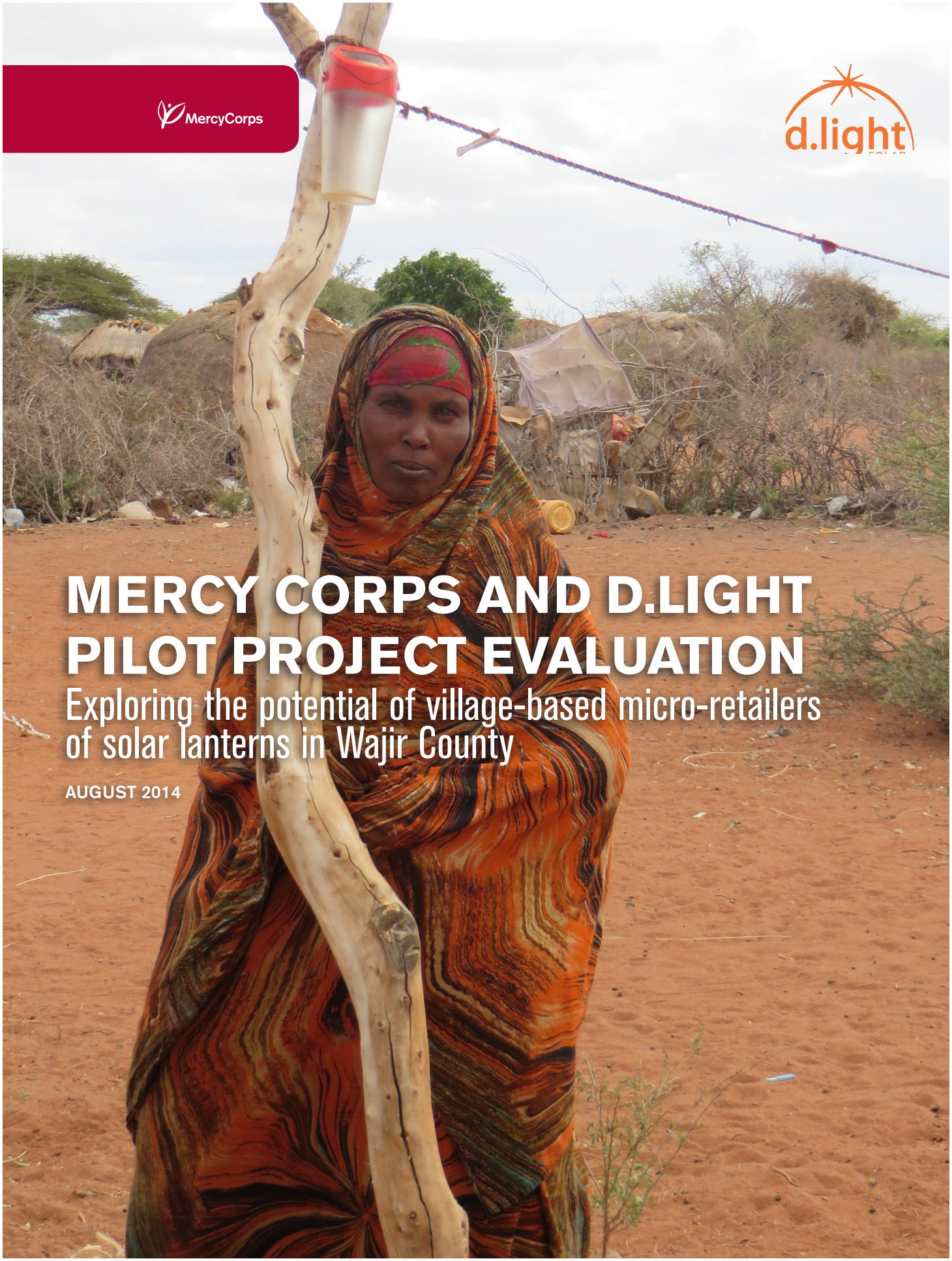

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MERCY CORPS AND D.LIGHT PILOT PROJECT EVALUATION

Exploring the potential of village-based micro-retailers of solar lanterns in Wajir County

AUGUST 2014

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INTRODUCTION AND METHODOLOGY

In May 2013, as part of Mercy Corps' Gates Foundation-funded project, Mercy Corps and d.light began implementing a one-year pilot project to explore the potential for village-based micro-retailers (VBMRs) of solar lanterns in Wajir County. Wajir is a county in north-eastern Kenya with a population of approximately one million people, predominantly living as pastoralists.

The Mercy Corps and d.light pilot project identified twenty individuals in thirteen villages in rural areas of Wajir County, and supported them to become village-based micro-retailers of solar lanterns. Support included training, a 75% grant contribution to their initial purchase of stock, a start-up kit consisting of a t-shirt and cap, and on-going business mentoring and advice. The project also worked with two sub-distributors (SDs) in Wajir Town, who purchased solar lanterns from Sollatek in Nairobi (the national distributor for d.light products in Kenya).

The evaluation was completed over eight days in May 2014. The following table shows the tools that were used as part of the evaluation:

TABLE 1: Evaluation Tools

Target Group	Evaluation Tool	# participants
Mercy Corps project staff	Key information interviews	2
Village-based micro-retailers	Focus group discussions	17
Village-based micro-retailers	Sales and stock survey	17
Sub-distributor	Key informant interview	1
Households: existing d.light consumers	Focus group discussions	17
Households: existing d.light consumers	Household survey	292
Households: non-d.light consumers	Focus group discussions	13
Households: non-d.light consumers	Household survey	119

HOUSEHOLD OUTCOMES:

Numbers of beneficiaries and demographic

An estimated 1,709 households are now using 2,557 d.light solar lanterns in Wajir County, as a result of Mercy Corps' Gates Foundation-funded project. Of these, 49% (837 households) are using more than one d.light product in their home. With an average of 7.8 members per household, this initiative has therefore provided benefits to more than 13,000 individual beneficiaries.

Products and product pricing

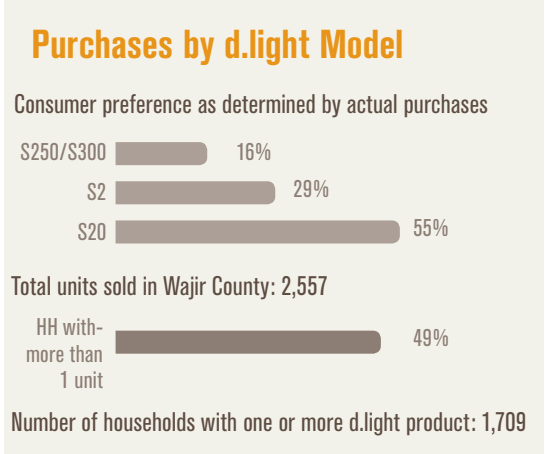
The most popular model purchased by households in Wajir has been the S20, with more than half of all products sold. Sales of the S250 / S300 are lowest at just 16%, in part due to the higher price but also because the sub-distributor and village-based micro-retailers have particularly struggled to maintain stock levels for this model. (Figure 1)

The table below shows pricing information for the products. The first three columns relate to actual prices paid by households, and the last two columns show the recommended retail prices (both before and after VAT was introduced in September 2013). The data shows some variability, with at least some households paying significantly lower and higher than the RRP. The average price paid for the S2 was lower than even the pre-VAT RRP, suggesting that businesses have been consistently offering households discounts on this product..

TABLE 2: Product Pricing

Product name	Average price paid	Minimum price paid	Maximum price paid	RRP (pre-VAT)	RRP (post-VAT)
S2	KSh 997 ($ 11.73)	KSh 800 ($ 9.41)	KSh 1,400 ($ 16.47)	KSh 1,000 ($ 11.76)	KSh 1,200 ($ 14.12)
S20	KSh 1413 ($ 16.63)	KSh 1,000 ($ 11.76)	KSh 1,700 ($ 20.00)	KSh 1,200 ($ 14.12)	KSh 1,400 ($ 16.47)
S250/ S300	KSh 3983 ($ 46.86)	KSh 3,300 ($38.82)	KSh 4,500 ($ 52.94)	KSh 3,400 ($ 40.00)	KSh 3,850 ($ 45.29)

FIGURE 1: Consumer preference as determined by actual purchases
Source: Vendor sales data



Outcomes

The focus group interviews and household surveys have shown that the impact of purchasing a d.light product for Wajir households is profound, and this is reflected in the apparent huge existing demand for the products among previous consumers and households that have not yet purchased.

In terms of **household usage**, participants spoke of the transformative effect of having far brighter lamps lighting their home, enhancing their evening hours and meal times. Women in particular described the way the lamps reduce the burden of everyday tasks such as collecting water and taking children to the toilet. A common practice in Wajir is to leave the lamp on all night on a low-setting to lessen the risk of dangerous insects such as scorpions crawling into bedrooms, and to make it easier for women to safely move around inside the house when they have to frequently get up during the night to look after children.

Wajir – William Baron for Mercy Corps

Savings on energy expenditure is the most important benefit of the d.light lamps, according to households that have already purchased the products. For households without a solar lamp, the primary source of lighting in Wajir County is conventional battery-powered torches or lanterns (98% of households use these on 'most days'). A relatively low proportion of households also use kerosene regularly (29% of households use it on 'most days'), due to problems with supply and also likely the high price.

On average, households in Wajir County without d.light lamps spend $11.50 per month (KSh 978) on purchasing torches, batteries and kerosene. After purchasing d.light lamps, all households surveyed completely eliminated kerosene expenditure, but still tended to spend a small amount of money on torches and batteries, with average expenditure of $2.32 per month (KSh 197). On average, therefore, households save $9.18 (KSh 781) per month on recurrent energy expenditure when using a d.light solar lamp, or $110.20 per year. For vulnerable rural households this is an extremely significant saving.

Among participants in focus group discussions, **educational usage** of the lamps was cited as the most important use of the d.light lamps for their households, indicating the extremely high importance parents place on their children's schooling. From the survey of households, 99% said that students in their home use the d.light lamps for studying, and all of these said that their children now study for more hours than previously when they had to use flashlights or kerosene. With an average of 3.26 students per household, this means a total of 5,567 children and young adults have benefited from better quality lighting for studying and more hours studying per night.

Mercy Corps' solar project was originally included in the Gates Foundation program with the goal of creating employment opportunities for youth. The number of individuals benefiting directly from establishing a d.light retail business is relatively low (see section 4.4.), but the indirect business and livelihood benefits of using solar lights appear to be very significant.

TABLE 3: Business and Livelihood Benefits

Business and Livelihood Benefits	
% of households reporting increased income from use of d.light solar lamps in their business	84%
% of households earning some income from providing a mobile phone-charging service to neighbours	18%
% of households reporting reduced loss of livestock to wild animals as a result of using d.light solar lamps	63%
Estimated average annual reduction in lost livestock assets due to wild animals	KSh 13,575 ($ 100.62)

Firstly, the majority of households benefit from using their solar lamp to help them increase income from an existing business. Out of 292 households surveyed that have purchased solar lamps, 254 (87%) of these run some kind of business, whether a retail business selling basic goods or clothes, a tea-shop or canteen or simply firewood collection and sales. Almost all of these (246 households) said they use their solar lamp as part of their business, typically enabling them to open their business later in the evening, and reported that the improved lighting had resulted in an increase in income for their business. In addition, 18% of households said that they

now get some income by using their d.light lamp to provide a mobile phone-charging service to neighbours. households using kerosene, in particular in relation to breathing and eye problems.

Secondly, the solar lamps help pastoralists to avoid losses of their livestock to wild animals. Almost all households own goats, sheep, cows or camels, which are kept in corrals at night sometimes close to the house, or sometimes outside the village. Attacks by wild animals such as lions, hyenas and wild dogs are extremely common, and it is often the role of young boys to guard the livestock at night, and to scare off wild animals. The household survey found that 63% of households use their d.light lamp at night to protect their livestock, for as participants in focus group discussions explained, when you have a light in the corral wild animals stay away. Of these, all said that they now lose less animals than previously. The monetary benefit of avoiding animal losses is substantial. On average, households without d.light lamps lose 6.0 heads of livestock per year to wild animals (according to Mercy Corps' household survey), predominantly goat and sheep.[1] Assuming that d.light lamps result in a 50% reduction in this livestock loss[2] , the average saving per household is therefore over $100 per year, even factoring in that only 63% of households use lamps to protect livestock. This is a huge benefit for households and communities, almost as high as the savings on energy expenditure.

Finally, in focus group discussions the **health benefits** of using solar lamps was raised by a number of participants that had previously used kerosene. The table below shows the incidence of various health problems experienced in the last year, using information from the household survey. Quantifying causality between kerosene usage and health problems is difficult, and would require a comprehensive study. But the data below shows that the reported incidence of certain health problems is far higher among

TABLE 4: Self Reported Incidence of Health Problems and Frequency of Kerosene Usage

Type of health problem	% of households experiencing the problem *Households that use kerosene on 'most days'*	% of households experiencing the problem *All households*
Breathing or throat problems	90%	27%
Eye problems	99%	29%
Burns	15%	5%
None of the above health problems	1%	71%

Constraints to Future Market Growth

There are a number of possible constraints to increased purchases of d.light solar lamps in the future by households in target areas, including: i) Lack of awareness and trust; ii) Market saturation; iii) Lack of stock availability; and iv) Poverty / Lack of capital.

The focus group discussions and household surveys show that a **lack of awareness and trust** of d.light lamps is not a significant constraint on future sales. Among households that have not yet purchased the products, 85% had already seen or heard about the products. Of these, 99% said they trusted the quality, and 97% said

1 The incidence of livestock loss to wild animals reported in Wajir is very high, representing 6.6% of total livestock per year. While this finding is backed up by focus group discussions and Mercy Corps field staff knowledge, it could be useful in future to do a more detailed assessment of animal loss.
2 Assuming a 50% reduction is probably a conservative estimate, as in focus group discussions participants reported that when they use d.light lamps they do not suffer any wild animal attacks at all.

they were planning to purchase a d.light product. This level of awareness is excellent, and it was clear from the evaluation that despite the supply constraints there is a real 'buzz' about the products, reflected in the fact that 61% of households first heard about the products from a friend or neighbour, compared with just 38% who heard about them directly from a retailer.

It also seems unlikely that **market saturation** will constrain sales for the foreseeable future. The table below shows market penetration of d.light lamps in target villages (some have been excluded due to lack of available data). On average, market penetration is almost 20% in target villages, which is relatively high. However, for a number of reasons demand is likely to remain strong for some time. Firstly, the table below assumes that all sales from each VBMR have been in their own village, whereas in reality the majority have also engaged in sales in surrounding villages; actual market penetration in the target villages below is therefore likely to be substantially less. Secondly, the number of customers for a given population size is likely to be very high in Wajir County, given the lack of competition from other energy sources and the high existing expenditure on energy. So whereas 25% to 50% penetration for d.light might be a realistic target in some villages in other areas of Kenya, in these villages in Wajir County a target of 80% or even 100% of households is certainly possible. This is reflected in the very high proportion of households that have not yet purchased but say they are planning to buy a lamp in the future (97% of households). Thirdly, demand is likely to remain high because many households will purchase more than one lamp. Already 49% of households are repeat customers, and of the 292 surveyed households that have already purchased at least one product, 99.7% are planning to purchase another d.light lantern.

FIGURE 2: Monthly energy expenditure and savings USD *Source: Household Survey*

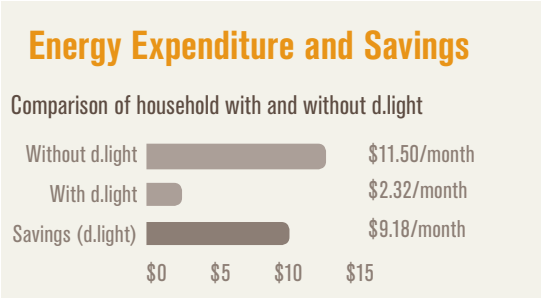


TABLE 5: Market Penetration

Name of village	No. of HHs already using d.light	Total HH in village	Market penetration to-date
Arbajahan	740	1,087	68%
Athibohol	103	580	18%
Hadado	230	1,223	19%
Ibrahim Ure	41	676	6%
Kursin	39	551	7%
Lagboqol	100	450	22%
Lolkuta South	112	657	17%
Machesa	132	565	23%
Makoror	40	1362	3%
Average market penetration			19.3%

The biggest constraint to future household purchases of d.light lamps is the **lack of stock availability**. Of the households that had not yet purchased a d.light lamp, 63% said the reason they have not done so is unavailability of products at their local retailer. This issue is discussed further in Sections 4 and 5 below. At a time when awareness of the d.light lamps is so high, and households are walking distances of up to 40km to visit a shop and buy a d.light lamp, the lack of stock availability is a huge disappointment to potential customers.

Finally, there is also the possibility that demand can be constrained in the future by the **poverty-level** and lack of capital of households. Another important question for Mercy Corps in terms of their broader mission to tackle poverty, is whether the market system for solar lighting products is reaching the poorest households.

A lack of available cash was the second most common reason given by households for their failure to previously purchase a d.light lamp (36% of households), indicating that cash constraints are at least temporarily binding for some households. However, the fact that 86% of households said that they are planning to purchase in the next three months or immediately when stock becomes available suggests most believe that they will be able to overcome their capital constraints after a period of saving.

To analyse possible wealth differences between customers and non-customers, we can compare various characteristics of households that have already purchased d.light lamps with households that have not yet purchased them, as presented in the table below.

The percent of households with a member in formal employment is extremely low for both categories and roughly similar, however a greater percentage of existing d.light consumers own a business. Most strikingly, existing d.light customers tend to have far greater livestock assets than other households, with over 70% owning assets of more than $10,000 compared with just 17% for non-d.light households.

TABLE 6: Employment Type and d.light Lantern Ownership

Indicator of poverty-level	Existing d.light customers	HHs that have not yet purchased d.light
% of HHs with at least one member in formal employment	5%	8%
% of HHs that own a business	81%	65%
Average livestock asset value (USD)	$21,408	$5,962
% of households with more than USD $10,000 in livestock assets	70%	17%

The findings therefore show that **households that have already purchased a d.light lamp are significantly wealthier than households that have not yet purchased a product.** This is a significant finding, but not altogether surprising. The market system for solar products in Wajir has only been operating for one year, and poorer households are less likely to be among the 'early adopters' of new and possibly risky technologies, and will require a longer period of saving. Assuming the problem of stock availability is overcome, it is quite possible that the poorest households will increasingly purchase d.light solar lamps, and the wealth differential between consumers and non-consumers will diminish over time. However, given Mercy Corps' commitment to working on market development initiatives that address the needs of the poorest-of-the-poor, it would be extremely valuable to re-visit this issue in 12 or 18 months, and analyse whether the outcome is still the same.[3]

3 At this point it would be beneficial to use a more accurate measurement of household poverty-level, such as a Kenya-specific PPI score-card.

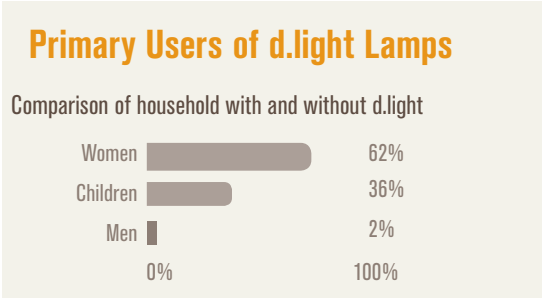
Gender

The evaluation also looked at gender roles and impact in relation to the solar lamps, in terms of both purchasing decisions and product usage.

The household survey of existing d.light consumers revealed that men still largely take responsibility for making the purchase of the product. This was the case in 80% of households, with women making the purchase in the remaining 20%. However, in focus group discussions participants suggested that for most households the decision to purchase is made jointly by husband and wife, and it is women that hold the purse strings.

In contrast, in terms of usage, it is overwhelmingly women who use the d.light lamps the most, as shown in the following graph. Given the choice of men, women and children, 62% of households responded that women are the primary users, with 36% of households saying that children use them the most (reflecting the high importance placed on education among Wajir communities).

FIGURE 3: Gender and d.light Lamp Usage
Source: Household Survey



Somali Region, Kenya —William Baron/Mercy Corps

VILLAGE-BASED MICRO-RETAILERS OUTCOMES

In May 2013 Mercy Corps supported twenty individuals in thirteen locations to become retailers of d.light solar products, selected on the basis of criteria including age (had to be younger than 30) and willingness to invest their own capital. Eleven of these individuals owned existing businesses, while nine were starting a new business. Five of the retailers were female. Data was collected from 17 of the businesses and only results for these are reported here.

Sales Performance

The table below shows the total monthly sales of d.light products by village-based micro-retailers (VBMRs) in the past 13 months. Two immediate observations can be made from this data. Firstly, sales of d.light products took-off immediately in Wajir County; sales in the first two months are the second and third highest on record. Secondly, after August 2013, sales were significantly lower, and from March 2014 dropped away completely so that at the point the evaluation was conducted there had been no sales for almost two months.

The reason for the falling sales is clear; the number of VBMRs actively selling products for a given month fell over time. From a peak of 15 out of 17 surveyed businesses actively selling in August 2013 (88%), the number steadily fell (see Figure 5.

The reason for this increasing inactivity of the VBMRs became apparent in focus group discussions and interviews with the businesses. Throughout the 13 months, but increasingly from 2014 onwards, the sub-distributor in Wajir town did not have any d.light products in stock (this issue is discussed further in section 4.2 below).

Another factor that likely contributed at least to a small extent to the fall in sales after August was the introduction of government VAT in September, and therefore an increase in the retail price of the d.light lanterns. However, given the strong sales performance of the VBMRs when they had stock, even after the price increase, this does not appear to be a major factor.

There has been significant variability in the sales performances of different VBMRs, as shown in the graph below.[4] In particular, one business owner named Ahmed was exceptionally successful, and throughout this analysis it is important to disaggregate for Ahmed's business as his performance skews the outcomes and could lead to misleading conclusions. On average, the VBMRs each sold 21.0 d.light products per month (for the months they had stock and were selling), though this average falls to 14.4 products per month when Ahmed is not included.

The following table classifies the businesses according to their performance-level. Overall, performance has been impressive, and even for a given 'selling month' the VBMRs would likely have achieved higher sales with better supplies of stock, as often the VBMRs would sell their stock in just a few days or week but then have to wait until the next month for more stock to become available from the sub-distributor.

4 The average is calculated for the months that the VBMRs were able to purchase stock and were actively selling products (henceforth 'selling months'), as this better reflects their actual sales experience. It doesn't include the months when they were unable to obtain stock from the sub-distributor and had zero sales.

FIGURE 4: **Monthly sales of d.light products in Wajir County**
(*Source: Vendor sales data)*

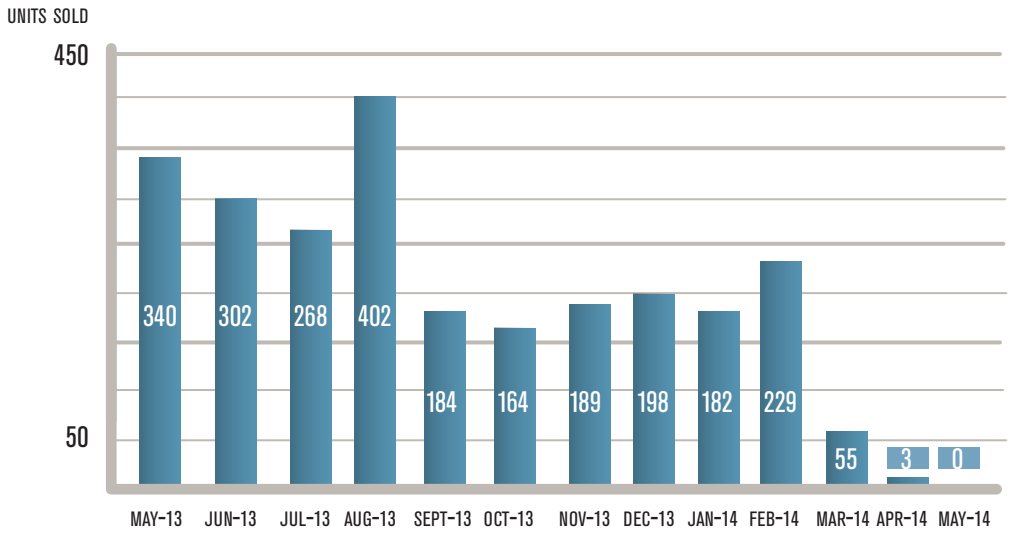


TABLE 7: **VBMR Performance Levels**

Performance-level (units sold per month)	No. of businesses and %
Low-performing (0-10 per month)	3 VBMRs (18%)
Medium-performing (11-25 per month)	13 VBMRs (76%)
High-performing (25+ per month)	1 VBMR (6%)

Purchasing Stock

The VBMRs all travel to Wajir Town to purchase stock from the sub-distributor, covering distances ranging from 15km to 180km, using public transport such as buses or trucks. The table below highlights the key characteristics of the VBMRs with respect to their stock purchasing.

TABLE 8: **VBMR Stock Purchasing**

Stock purchasing characteristic (per VBMR)	Average (not incl. Ahmed)	Average (incl. Ahmed)
# of stock purchases (in 13 months)	5.8	5.7
# of d.light units per stock purchase	19.8 units	29.6 units
Number of 'selling months' per stock purchase	1.3	1.3
Expenditure per stock purchase	KSh 14,185 ($ 167)	KSh 25,289 ($ 298)
Initial investment in stock (not including Mercy Corps contribution)	KSh 11,760 ($ 138)	Ksh 11,830 ($ 139)

Maintaining adequate stock levels has been the major factor restricting higher sales and income for the VBMRs, and is largely due to the frequent unavailability of stock at the Wajir Town sub-distributor. On average, the VBMRs were without stock in their business for 5.5 months, or 43% of the entire period, suggesting that the number of households reached could have been as high as 2,450 households if the supply chain had been functioning efficiently. This was not always the fault of the sub-distributor, as at times the national supplier Sollatek also ran out of stock (most notably from March 2014).

Many areas in which the VBMRs are located do not have telecommunications coverage so they are unable to phone ahead to check stock availability. Most businesses said that on several occasions they had travelled to Wajir Town only to find no stock available, and the high costs associated with transport for these trips significantly affected their profitability due to the relatively small margins.

Unreliable stock availability has a greater impact than just missed opportunity for sales, as there is a real risk that retailers will drop out of the supply chain. This appears to have happened for four of the seventeen VBMRs (24%), which last purchased stock and sold d.light lamps in October 2013. In focus group discussions and interviews, all four of the businesses seemed to genuinely want to continue their business and complained that stock availability is the only reason they are not selling. But since the sub-distributor did subsequently have stock after they stopped selling, this highlights the risk that breaks in the supply chain have in terms of creating uncertainty for retailers.

Lack of stock at the sub-distributor was such a problem that on one occasion Ahmed (the high-performing VBMR) chose to purchase stock directly from the national supplier Sollatek, rather than wait for stock to become available at the Wajir Town sub-distributor.

FIGURE 5: Number of VMBRs selling per month (*Source: Program database*

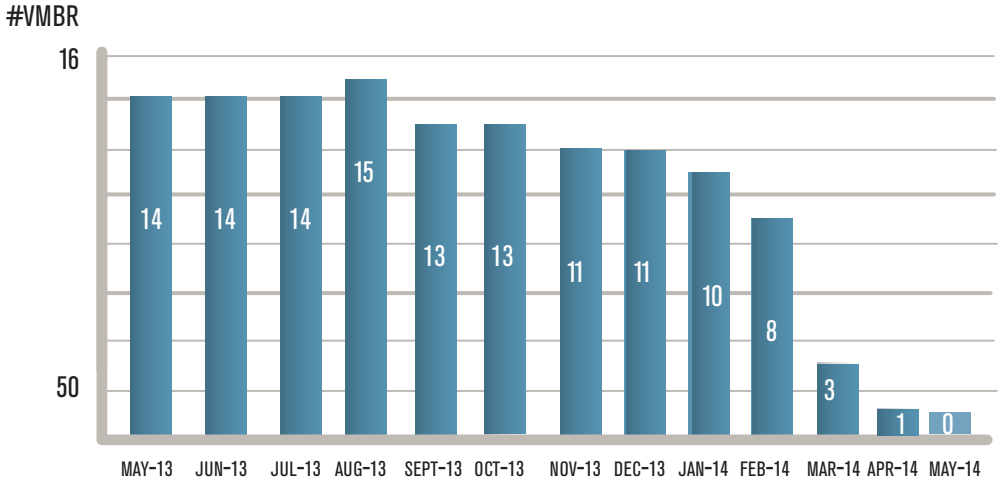
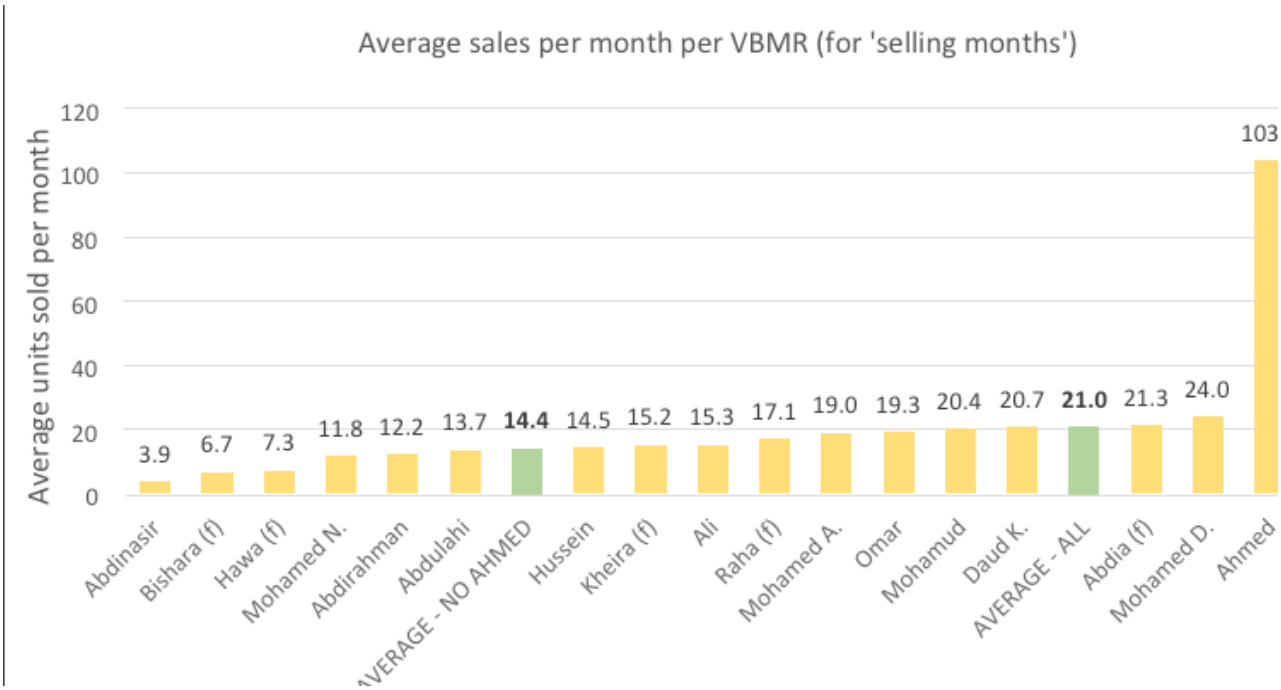


FIGURE 6: Average Sales per Month per VBMR ('selling months')
(*Source: Program sales data)*



Business Practices

Managing Business and marketing skills among the VBMRs appear to be excellent, reflected in the impressive sales data and high awareness of d.light products among households in their operational areas.

The main marketing and sales technique used by all the VBMRs is door-to-door promotion and sales. The business owners visit households during the day (and sometimes at night) and will spend up to an hour with the household demonstrating the products and answering questions. In some cases they allow the household to use a product for a few nights, after which the household can decide whether to buy it (and reportedly almost always do). Other techniques used include promoting the solar products at mosques, and to a lesser extent at schools (where there are apparently a number of existing initiatives to distribute free solar lights). The businesses are extremely proactive, spending 8 or 9 hours per day and six or seven days per week marketing and selling the lamps when they have stock available. They generally have no problem selling several products in a day, and the tendency is to sell off their stock quickly but then to have significant periods when they have no stock and engage in other business activities.

Despite the logistical difficulties, many of the businesses (though not female VBMR-owners) are also travelling to other surrounding villages to promote the products. Accessing these additional markets mainly involves walking long distances, between 20km and 40km, carrying the products. In a few cases the business owners travel by bus or motorbike, though this is relatively expensive. This appears to be paying off, as the VBMRs report that as awareness increased they received a growing stream of households walking from other villages to their shop to buy d.light products. While visiting other villages, family members of the VBMR-owner look after the business.

Another common practice is provision of credit to households they trust, typically paid back over a period of up to two months. The household survey showed that 19% of households purchased their d.light lamp with credit from the retailer, a significant proportion. Two businesses (including the high-performing Ahmed) are also using

sub-retailers or sales agents, individuals in other villages who receive a small commission for each product they sell. This is an excellent development, and should be integrated into future business training for VBMRs as something they can replicate.

With a perfectly functioning warranty system the VBMRs should be able to identify products that have manufacturing defects and replace them immediately for consumers, while products that are not functioning due to consumer misuse can be returned to the national supplier for repairs. The warranty system in Wajir appears to be functioning, but very inefficiently. The VBMRs and the sub-distributor in Wajir town are unable to identify products that have a genuine manufacturing defect and products that have been damaged by customer misuse, and consequently all products get sent to the supplier in Nairobi. Most products do eventually get returned to the customer, but this can be a period of two to five months.

Out of 292 surveyed households, 15 households (5%) had returned d.light lamps that had stopped working. Of the 21 lamps returned, 12 lamps had been successfully replaced through warranty and 9 lamps had not yet been returned. This is a poor performance indicative of the inefficiency of the warranty process for Wajir, and results in increased transaction costs for the VBMRs (who have to keep pestering the Wajir town sub-distributor about the products) and also for the sub-distributor. The current process also depends on the willingness of Sollatek to receive all products and make repairs (where warranty is not valid) for free, which may not continue in the future.

TABLE 9: Warranty Statistics

Warranty statistics	%
% of households returning a product	5.1%
% of products returned	4.8%
% of returned products received back	57%

The training provided by d.light and Mercy Corps appears to have been a key factor in this success of the VBMRs and their widespread use of proactive sales techniques. The VBMRs gave extremely positive feedback on the 'product information' and 'sales and marketing' components of the d.light training in particular. The t-shirts and caps that were part of the start-up kit were also widely used, and businesses and households alike reported that these helped generate trust in the products. Finally, the natural business acumen of the VBMR owners came across strongly in the course of this evaluation. The business men and women are highly motivated, confident and skilled in reaching out to their customers, and this was undoubtedly an underlying reason for their success. In part this is the result of good selection by the Mercy Corps program team, but also appears to be an attribute of the local Somali peoples more generally.

Income and Employment Benefits

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Mercy Corps originally designed this solar lantern project with the objective of generating employment and income opportunities for youth in areas hit by the 2011 drought.

In practice, the number of new jobs generated by the project is very low. Eleven of the VBMR-owners had existing businesses, so the number of individuals directly benefiting from new employment is approximately nine. As described in section 1.1 above, far more impactful for incomes and livelihoods in Wajir has been the boost to disposable income of poor rural households from savings on energy expenditure, and the opportunities the lights have provided for increased business income and reduced loss of livestock to wild animals. Nevertheless analysis of the revenue and profit for VBMR-owners is important, to understand the ability of the business model to generate income for the VBMRs and therefore be sustainable. The following table shows the key characteristics of the VBMRs with respect to their income.

TABLE 10: VBMR Business Income and Expenditure Charteristics

Income characteristics (per VBMR)	Average (not incl. Ahmed)	Average (incl. Ahmed)
Revenue (for 13 months)	KSh 170,669 ($ 2,008)	KSh 234,585 ($ 2,760)
Gross profit (for 13 months)	KSh 31,453 ($ 370)	KSh 43,868 ($ 516)
Monthly gross profit (for 'selling months')	KSh 4,688 ($ 55.15)	KSh 5,997 ($ 70.55)
Monthly transportation costs	KSh 886 ($ 10.42)	KSh 889 ($ 10.46)
Estimated monthly net profit (for 'selling months')	KSh 3,802 ($ 44.73)	KSh 5,108 ($ 60.09)

It is useful also to understand profit-levels with respect to the performance-classifications highlighted above. The following table shows the average monthly gross and net profit for each.[5]

TABLE 11: VBMR Gross and Net Profits

Performance classification	Average gross profit per 'selling month' (per VBMR)	Average net profit per 'selling month' (per VBMR)
'Low-performing' VBMRs (0-10 units per month – 3VBMRs)	KSh 1,926 ($ 22.65)	KSh 1,340 ($ 15.76)
'Medium-performing' VBMRs (11-25 units per month – 13 VBMRs)	KSh 5,325 ($ 62.65)	KSh 4,370 ($ 51.41)
High-performing' VBMRs (25+ units per month – 1 VBMR)	KSh 26,944 ($ 316.99)	KSh 26,000 ($ 305.88)

For the 'medium-performing' VBMRs (76% of businesses), average gross profit of $63 per month (net profit of $51) represents a substantial income, especially taking into consideration the fact that most owners do not

5 It is difficult to be accurate when calculating overhead costs. For example, some businesses integrate transportation costs for stock purchases into their broader business, and other costs such as transportation to neighbouring villages is difficult to capture. For these calculations, overhead costs are assumed to be their transportation solely for purchasing stock, taking into account the frequency of trips and costs for a specific business.

work full-time on actively selling the products. The owners' willingness to engage extremely proactively in sales outside their shop is the best indication that they are appropriately incentivised by their profit level.

For the 'low-performing' VBMRs, gross profit averages only $23 per month and net profit just $16. However this does not mean 'low-performing' VBMRs are necessarily unviable or unsustainable. For existing businesses this level of sales can still provide a welcome extra income, especially since some of the transportation overheads can be absorbed into the broader business. Even for new businesses operating as stand-alone solar retailers, they can easily engage in d.light sales on a 'part-time' basis as most owners only work for a certain number of days per month.

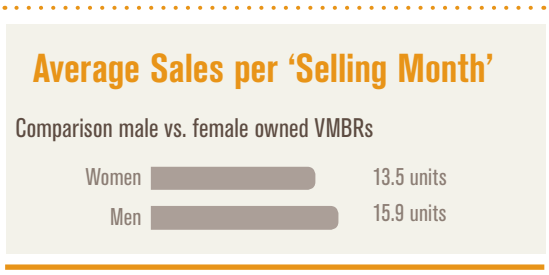
Finally, the performance of the sole 'high-performing' VBMR shows what level of income is possible; Ahmed's stellar business generated gross profit of $317 per month (net profit of $306). While his overhead costs are likely to be slightly higher given he pays commission to several sub-retailers and uses public transport to visit other villages, this is nevertheless a huge amount of money for a micro-business in a remote rural area of Wajir.

Success Factors

Given the success of this project and the profound impact on the lives of thousands of vulnerable rural households, Mercy Corps should aim to expand across Wajir and replicate this approach in other areas of Kenya. Key to the success is selecting the right individuals to become solar retailers. Two key characteristics that could influence these choices are the gender of the individual, and whether the individual owns an existing business. Data is limited with only five out of the seventeen surveyed VBMRs owned by women (29%), so findings here are somewhat tentative.

The following graph shows average monthly sales disaggregated by gender (and does not include Ahmed's results as this heavily biases the findings). The data indicates that there was not a substantial difference between the performances of female- and male-owned VBMRs, with the latter selling 18% more units on average.

FIGURE 7: Average Sales Comparison Female vs. Male Owner
Source: Household Survey



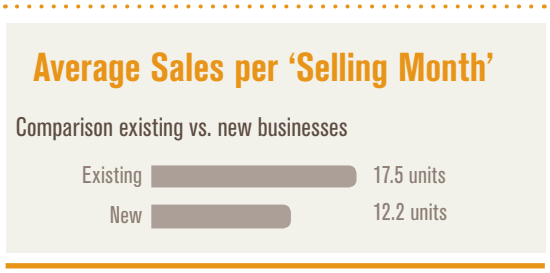
Feedback from households in focus group discussions suggested that both male and female VBMR-owners are easily able to do door-to-door visits and promote the products to households, though one or two participants thought that women are better able to promote the products when selling to female consumers. The fact that for 62% of households it is women who are the primary end-users of the solar lamps, and that is usually women who are the purse holders for a household, suggests that females may be in a better position to convince their peers about the benefits.

While women may have a slight advantage in terms of generating sales in their home village, there were no instances of women travelling to other villages to sell products and this is probably the main reason for their slightly lower sales on average. There are several likely reasons why women were not able to engage in sales in other villages, including: long distances to walk in intense heat; the need to be close to home to look after children; and the social unacceptability and risk in women travelling alone in remote areas. These factors may also provide a hindrance to stock purchasing trips for women in locations far from the sub-distributor, and therefore affect their willingness to start such a business in the first place; notably, the average distance of female-owned VBMRs from Wajir Town is 55km, compared with an average of 98km for male-owned VBMRs.

One possible solution to maximise the respective strengths of female and male solar retailers could be to encourage joint partnerships between men and women in a given location. This happened spontaneously in one village where Mercy Corps established two VBMRs, one female-owned and one male-owned, and they independently formed a profit-sharing partnership, pooling resources to buy stock thereby reducing overheads, with the man travelling to other villages and the woman marketing products in their home village and serving customers at the shop.

The following graph shows average sales per month disaggregated according to whether the VBMR was an existing or new business (and again does not include Ahmed's results).

FIGURE 8: Average Sales Comparison Existing vs. New Business
Source: Household Survey



In this case the data shows a much clearer difference between the two categories, with existing businesses on average selling 5.3 units more per month than new businesses (44%). Possible reasons for the superior performance by existing businesses include: greater access to capital (existing businesses spent an average of $198 per stock purchase compared with $127 for new businesses); more experience in promotion and marketing; a better reputation in the community; ability to absorb transportation costs into their other business activities; and an existing physical business from which to sell products.

Key Constraints to Improved Performance for VBMRs

While the sales performance and promotion efforts of the VBMRs has been impressive, the market system nevertheless faces a number of problems, most notably the large numbers of months in which VBMRs are not able to sell and the falling number of participating VBMRs over time. The following four constraints are currently hindering, or have the potential to hinder, the VBMRs' ability to increase sales and reach greater numbers of households:

1. Unavailability of stock: By far the most damaging constraint facing the VBMRs is the frequent lack of stock availability at the sub-distributor. This has resulted in many months in which the VBMRs are not able to sell products at all, and likely reduced units sold even in 'selling months'. It also creates the risk of VBMRs dropping out of the market altogether, as appears to have happened with four of the VBMRs. Addressing

the reliability of the supply chain is the main challenge to ensure sustainability and a foundation for replication.

2. Access to finance or trade credit: Many of the VBMRs identified a lack of access to finance or credit as a key constraint preventing them from increasing sales and profits. The regular stock shortages at the sub-distributor are a significant factor in this perception, as in the minds of VBMR-owners more capital would allow them to take advantage of the times when the SD does have stock available and purchase bigger orders. A reliable supply system would therefore go a long way to reducing the need for more capital, as the businesses could replenish their stock regularly and in smaller amounts. However, in two ways, finance or credit would indeed help to boost the VBMRs' performance. Firstly, it would enable them to provide more credit to their customers, a practice they are already using with significant success. Secondly, it would increase their profits as it would enable them to reduce their number of trips to Wajir Town and therefore reduce their expenditure on transportation overheads.

3. Poorly functioning warranty system: As described above, the warranty system is functioning poorly, with customers often waiting two to four months to receive their replacement or repaired product. Underlying this is the inability of the VBMRs and the sub-distributor to differentiate between genuine manufacturing defects and human misuse, the result of which is that all products get sent to Nairobi regardless of the problem. This damages the reputation of the VBMR in their community, and puts the owner in an extremely difficult situation with consumers angry that the warranty promise is not being kept. There is evidence that in some locations this is beginning to damage sales; for example one business owner said that she has stopped selling completely until she receives three products back from the sub-distributor, which she returned five months previously.

4. Competition from 'fake' and subsidised solar products: In focus group discussions participants repeatedly mentioned the presence of 'fake' solar products, including imitation d.light products (though during the evaluation it was not possible to actually find these). At present these do not pose much threat to the sales performance of the VBMRs, as customers seem to be well informed about the superior characteristics of official d.light products and the status of 'official' d.light retailers. Potentially more of a problem in the future could be competition from good quality solar lamps that have been distributed or sold at a subsidised rate by other development organisations, particularly given the presence of refugee camps nearby. Some of these products are already finding their way to markets in Wajir, but the numbers are not currently sufficient to have had a significant effect on demand for the VBMRs' products.

SUB-DISTRIBUTORS (SD)

Mercy Corps originally supported two sub-distributors (SDs) based in Wajir Town to act as distributors of d.light solar lamps for Wajir County. By the end of the project period in May 2014, one of these (Bishara) had closed operations and left the region, while the other (Al-Marshidy) was still operating.

Sales Performance and Stock

The table below shows the number of d.light solar lamps that each of the SDs has sold over the 13 months of the project.[1]

1 Obtaining these records from the Nairobi supplier Sollatek was extremely difficult, and it is possible that some orders are missing, based on the information from SDs and from sales records of the VBMRs. These numbers also do not include the stock ordered directly by Ahmed (one of the VBMR owners), or stock ordered by Al-Marshidy at the end of May, but which hadn't arrived at the time of the evaluation.

TABLE 12: Sales performance of Sub-Distributors

Model	No. of units sold (Al-Marshidy)	No. of units sold (Bishara)	No. of units sold (both SDs)	% of total units by model
S2	474	120	594	28.7%
S20	462	672	1,134	54.7%
S250 / S300	254	90	344	16.6%
All models	1,454	882	2,072	100%

During interviews with the owner of Al-Marshidy, it was clear that the sales performance has not met his expectations, and he does not consider it a significant source of revenue for his business. The owner repeatedly stated that his primary motivation for involvement is helping the poor people of Wajir County.

This perhaps explains why Al-Marshidy has repeatedly failed to maintain stocks of d.light lamps. No precise data is available showing the dates when the business ran out of stock, but from interviews with the VBMRs it seems that they were unable to buy stock in the following months: most of August; throughout September; throughout November; most of January; and from March onwards. Even in other months, many businesses said they were unable to purchase stock of the models that they wanted, in particular the S250 / S300. A lack of supplies from Sollatek at the national level was sometimes the reason for Al-Marshidy's stock shortages, particularly the unavailability of the S250 / S300 in November and December, and the complete unavailability of stock from March onwards. Likewise, occasional delays in transportation (which take approximately two weeks to reach Wajir Town) contributed slightly to delays.

However, the most important factor in the lack of stock at the level of the sub-distributor was simply poor stock management and business planning on the part of the owner, which meant he ordered too little stock, too infrequently. It is notable that after ordering more than 300 units per month in the first two months, the average order by Al-Marshidy was less than 200 every two months. Given the very high demand among households and VBMRs, it is hard to identify an obvious explanation for this failure. The underlying reasons seem to lie in the nature of Al-Marshidy's business and his attitude to the initiative, in particular the following factors:

- Al-Marshidy is a hardware, construction, vehicle fuel and spare parts business, which has very rapid turnover of stock, in part because they seem to act as a wholesaler for a number of other businesses. Despite selling out d.light stock easily within two months of making the purchase, the owner views this as very slow-turnover and therefore unsuccessful.

- While the owner of Al-Marshidy seems happy enough to go along with Mercy Corps' recommendations, he did not show signs of 'buying-in' to the long-term vision of a distribution network for solar lanterns in Wajir, and seeing it as a genuine part of his business.

- Al-Marshidy is a relatively large business by Wajir standards, and revenue and profit from d.light lamps represents a very small portion of its overall income (see 5.2 below). The owner is a busy man, and seems not to be able or willing to invest much time in the solar lamp component of his business.

- In interviews, the owner claimed that he had plenty of capital, and indeed availability of cash probably was not a constraint on the size of the orders he was able to place. Nevertheless, given the high turnover for other products in Al-Marshidy, the owner clearly thought he frequently had excess inventory of d.light lamps, and it is likely that he kept orders of stock small in order to avoid tying up his working capital.

Revenue and Profit

The table below shows revenue and gross profit for the SDs over the 13 month period of the project. The main observation here is that gross profit of $3,212 for Al-Marshidy represents profit of $247 per month, and in relation to the overall business this represents a very small return. This poses a real risk to the sustainability of the entire market system, as it makes it more likely that Al-Marshidy will lose interest and fail to maintain appropriate stock levels over time, as already seems to be happening.

TABLE 13: Revenue and Profit of Sub-Distributors

	Al-Marshidy	Bishara	Both SDs
Revenue (KSh)	KSh 2,142,100	KSh 1,146,400	KSh 3,288,500
Revenue (USD)	$ 25,201	$ 13,487	$ 38,688
Gross profit (KSh)	KSh 273,046	KSh 148,008	KSh 421,054
Gross profit (USD)	$ 3,212	$ 1,741	$ 4,954
Monthly gross profit (USD)	$ 247	$ 134	$ 381

Market System and Supporting Services

For the market system for solar lanterns to be functioning effectively, to be resilient to shocks (for example disruption to supply), and to be self-replicating, the SD should be providing some supporting services to the downstream retailers. Possible activities in which the SD can engage include:

- Identifying new VBMRs
- Contacting VBMRs when stock becomes available
- Informal business mentoring (discussing sales performance and marketing techniques)
- Informal technical training, in particular in relation to identifying genuine manufacturing defects
- Providing marketing and promotion materials and participating in promotion activities
- Transporting stock
- Provision of credit

Not all of the above are necessary for a smooth-functioning and resilient distribution network, but they are indicators of the health of the market system. Based on interviews with Al-Marshidy and focus group discussions with the VBMRs, it is clear that in Wajir the SD has a very disengaged relationship with other actors in the network.

Almost all the VBMRs said that when they come to Wajir Town to purchase stock they never speak with the owner of Al-Marshidy, and there seemed to also be a gulf in communication also with regards products that had been returned under warranty. No training was taking place, and although one or two VBMRs had said they requested credit from the SD, none had ever received stock on credit. Al-Marshidy had no idea what marketing and promotion techniques the VBMRs were using, and had no marketing materials visible at the shop. Al-Marshady had sold a few d.light units to five other businesses not part of the Mercy Corps project, which is a positive sign that the owner is thinking about replication, but sales to these have not been significant and it seems unlikely that without further support they would develop into the type of effective retailers seen among many of the participating VBMRs.

BUSINESS MODEL / PROJECT ANALYSIS

The market system established by Mercy Corps in this project, with participation by d.light, represents a new approach to last-mile distribution for solar lanterns in Kenya. This section summarises the main findings.

Existing d.light Business Model in Kenya

d.light has relatively well-developed distribution channels for its solar lamps in Kenya, probably the most successful for energy products in the country. Their primary business model involves three companies that acts as importers and national distributors of d.light (Sollatek, Total and SunnyMoney) and over 400 independent 'outlets' that retail the solar products in towns, primarily in Rift, Western, Nyanza and Central provinces. Essential to this business model, however, is also d.light's team of sales staff (50) that go to villages and engage in direct marketing, selling products on behalf of the outlets and generating awareness about the outlets. With sales of over 600,000 units in FY2014, this model is working relatively well, and with market penetration of approximately 15% in target areas there is plenty of scope for growth.

Nevertheless, in many parts of the country (both areas of high-population density and more marginal areas such as Wajir), distribution networks of d.light lamps are not successfully penetrating the last mile and reaching villages. To expand d.light's current system of employed sales agents requires a fairly big investment, and while d.light have ambitions to expand coverage they also have to be realistic about taking on new geographical areas, and limits on the number of their sales staff is a constraint on how many villages they can target. Marginal areas like Wajir are particularly low-priority for d.light and other companies in the energy sector, and are likely to remain under-served for many years.

An Alternative Model - Village Based Micro Retailers

Under this Gates Foundation-funded project, Mercy Corps and d.light partnered to pilot an alternative business model for solar lamp distribution channels. The key innovation introduced in Wajir has been village-based micro-retailers (VBMRs), who purchase stock from a sub-distributor and market the products directly to households in their village and in neighbouring villages. This section analyses the main outcomes of the project and this model.

TABLE 14: Mercy Corps and d.light investments

	Project only (1 year)	Over 5 years (lifetime of d.light product)
Mercy Corps investment (stock, staff and training)	$ 14,684	$ 14,684
d.light investment (staff and kits)	$4,183	$ 4,183
Total investment	$ 18,867	$ 18,867

The following are the benefits that households have accrued during this first year of the project:

TABLE 15: Household net benefits for sales made in 1st year of the project[2]

	Project only (1 year)	Over 5 years (lifetime of d.light product
Number of households using d.light lamps	1,709	1,709
Cumulative net savings on energy expenditure	$ 136,993	$ 890,036
Cumulative net savings on livestock losses	$ 171,959	$ 859,793
Total net savings for households	$ 308,952	$ 1,544,759

In reality, the VBMRs are continuing to sell products and reach new households every month. The following table shows household net benefits assuming a hypothetical scenario in which the number of households reached in the first year is replicated in the next four years (i.e. 8,545 households are reached):

TABLE 16: Household net benefits including projected sales based on program targets

	Project only (1 year)	Over 5 years (lifetime of d.light product
Number of households using d.light lamps	1,709	8,545
Cumulative net savings on energy expenditure	$ 136,993	$ 4,450,182
Cumulative net savings on livestock losses	$ 171,959	$ 4,298,963
Total net savings for households	$ 308,952	$ 8,749,145

The following table summarises the net benefits for the VBMRs and sub-distributors during the project lifetime:

TABLE 19: VBMR and sub-distributor net benefits

	VBMRs (one year)	SDs (one year)
Number of businesses	20	2
Cumulative initial investment	$ 2,783	$ 7,728
Cumulative net profit	$ 7,596	$ 4,954
Return on investment	273%	64%

2 The estimates for savings on livestock loss should be treated somewhat cautiously, as this is the first time Mercy Corps has attempted to capture this information. Note also, however, that these benefits do not include increased income from the use of lamps in households' businesses.

Summary of Project Impact

With an investment of just $18,867 by d.light and Mercy Corps, this project generated cumulative net benefits of more than $135,000 for households in Wajir County in energy savings in the first year alone. This will rise to more than $890,000 over the next five years as households that have already purchased lamps continue to benefit from energy savings.

This return on donor investment is even more impressive when one considers other livelihood and income benefits for households, in particular savings on livestock loss to wild animals, estimated at $860,000 over the same five year period.

Finally, given the aim of creating a sustainable market system that continues to function and reach new households beyond the one-year lifetime of this initiative, these net benefits are likely to be substantially higher still. In the final section of this evaluation the potential for sustainability will be discussed, but as an indication of what is possible, if the VBMRs continue selling at the same rate for another four years then total net benefits for households is estimated at more than $8 million (over a five year period of owning the lamps).

CONCLUSIONS AND RECOMMENDATIONS

This evaluation of the Mercy Corps and d.light project to establish a distribution network of village-based micro-retailers (VBMRs) in Wajir County has produced numerous interesting outcomes, described throughout the report. This section will summarise the main conclusions and recommendations, in particular relating to future activities.

1. **There is a large and viable market for solar lamps in Wajir County, and Mercy Corps and d.light should continue to develop and expand distribution channels:** This report has highlighted the huge benefits for households purchasing solar lamps, with the reduction in lost livestock assets a particularly interesting finding. While the existing network is showing promise of at least some sustainability, there are signs that it is beginning to disintegrate. A one-year project is too short a time to develop a new and sustainable market system, and Mercy Corps and d.light should seek funding to strengthen the existing network and replicate it in new villages.
2. **The village-based micro-retailers (VBMR) have proven an effective sales mechanism for solar lamps:** The report has shown that 76% of business are categorised as medium-performing, and this is despite the huge problems they have faced in accessing supplies. The VBMRs in Wajir have demonstrated excellent marketing and business skills and it is clear that they are appropriately incentivised to engage in sales of the products to their neighbours and neighbouring villages. Mercy Corps should now more clearly define this model, including selection criteria and an information package showing potential returns. d.light should also formalize this model allowing for a “business in a bag” option for locations where the appointment of direct sales agents is not a priority. The idea of joint female- and male-owned businesses should also be explored as a key part of the model.
3. **The biggest threat to sustainability of the Wajir market system for solar lamps is stock-control problems and, underlying this, an inappropriate sub-distributor partner:** The lack of stock has constrained sales performance and resulted in several businesses effectively dropping out of the network. This evaluation suggests that the underlying reason for this is a sub-distributor partner that does not have the right incentives to focus on the solar lamp component of the business, which also undermines potential for replication. This was compounded by the SD receiving very little support from Mercy Corps and d.light in the course of the project. If Mercy Corps is able to get funding to expand distribution networks in Wajir, they should seek an alternative sub-distribution mechanism and partner. It may also be advisable to have more

than one sub-distribution partner, to avoid risk of county-wide stock-outs, but sufficient sales levels for a given sub-distributor will need to be maintained that keep them interested.

4. **Mercy Corps should move away from an intervention approach in which we directly identify and support VBMRs:** This is the dominant approach with which Mercy Corps has implemented solar distribution network projects (for example in Wajir, Timor-Leste and Northern Uganda). This results in ineffective relationships between SDs and VBMRs, leads to questionable sustainability, and does not produce the dynamics necessary for self-replication. Moreover, it constrains Mercy Corps' ability to reach genuine scale. The recommendation of this report is that Mercy Corps should instead entirely work with market agents one step back from the VBMRs. It is beyond the scope of this report to describe in detail what this alternative model might look like, but in essence the recommendation is that Mercy Corps should work with 'super-agents' at county town level, that are responsible for selecting and supporting VBMRs in a particular area. The super-agents would receive income based on the sales performance of 'their' VBMRs, or alternatively could also act as sub-distributors getting a margin (but essential is that they do not have a large existing business). Another possibility is that the super-agents could be sales staff from an energy supplier such as d.light. Instead of providing start-up capital for VBMRs, Mercy Corps could instead provide matching grants for 'super-agents' for their initial stock purchase if they are acting as sub-distributors.
5. **In establishing distribution channels, Mercy Corps should aim to integrate other social impact products where viable:** Mercy Corps should immediately begin exploring the potential to integrate cookstoves into distribution channels in Wajir, with the evaluation suggesting there is potential given that 27% of surveyed households get some income from firewood collection and sales. Water filtration products also sell well in other parts of Kenya, and could be explored.
6. **In future, Mercy Corps and d.light should provide further training on the warranty system, and better support for sub-distributors / super-agents on stock management:** Training on the warranty system is essential so that VBMRs and SDs are able to differentiate genuine manufacturing defects and consumer misuse. Stock management has been such a problem in the Wajir project (but also in the Timor-Leste energy program) that Mercy Corps should also think clearly about how we can better support partnering businesses.
7. **In future collaborations, Mercy Corps and d.light would benefit from improved communication and information-sharing during the project:** Information flows between Mercy Corps and d.light during the one-year project appear to have been limited. With better data collection and information-sharing, several of the problems encountered, in particular relating to stock supply issues, could perhaps have been addressed and avoided. In future, quarterly meetings to discuss pilot project outcomes and lessons are recommended.

ABOUT MERCY CORPS

Mercy Corps helps people turn the crises they confront into the opportunities they deserve. Driven by local needs, our programs provide communities in the world's toughest places with the tools and support they need to transform their own lives. Our worldwide team in more than 40 countries is improving the lives of 19 million people. For more information, see **mercycorps.org**.

ABOUT d.light DESIGN

d.light is a for-profit social enterprise whose purpose is to create new freedoms for customers without access to reliable power so they can enjoy a brighter future. We design, manufacture and distribute solar light and power products throughout the developing world. We aim to transform the lives of at least 100 million people by 2020.

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