التعاون الألماني
DEUTSCHE ZUSAMMENARBEIT

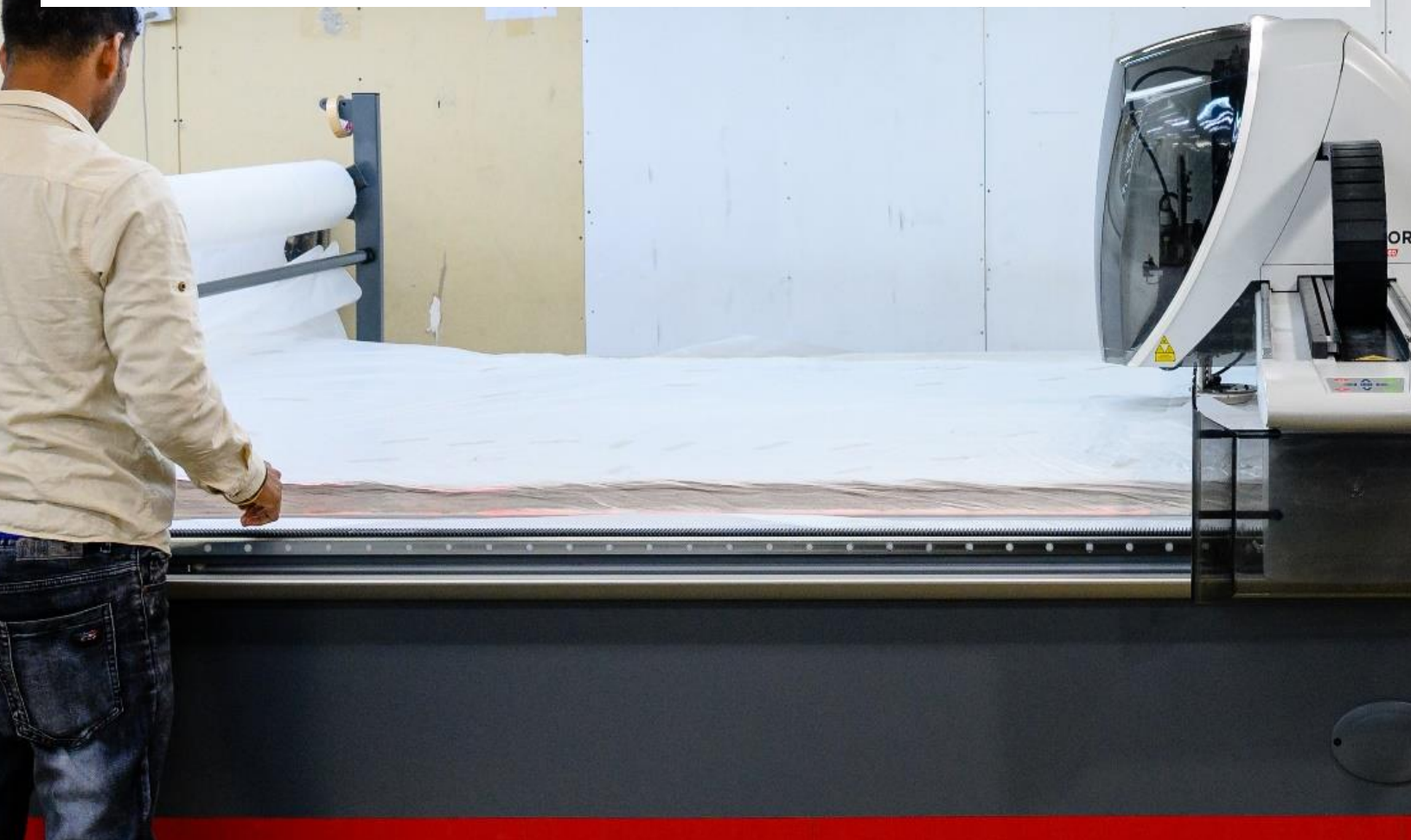
Implemented by
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

The Hashemite Kingdom Of Jordan
Ministry of Industry , Trade and Supply

Ministry of Environment

Business Case 1: Investing in Material-Efficient Technology and Software

Introducing Circularity as a Business Opportunity to Jordan's Ready-Made Garment (RMG) Sector



BACKGROUND

The "Green Action in Enterprises" (GAIN) project, commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) and implemented by the *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ) *GmbH,* works in close cooperation with the Ministry of Environment, the Ministry of Industry, Trade and Supply and other stakeholders towards the green industrial transition by introducing sustainable use and management of energy, water, and waste in the sector.

In Jordan, the garment manufacturers at Al-Hassan Industrial Estate (HIE) generate 35 tonnes of solid textile waste per day, which is being disposed of in municipal landfills. This textile waste is being treated as a cost factor harming Jordan´s fragile ecosystem. However, textile waste also does involve numerous opportunities and could be recognised as a valuable resource on regional and international level on the long term. Based on collected quantitative and qualitative data, a list of circularity options was explored. **5 business cases** have been developed which provide marketable solutions for textile and garment waste minimisation, prevention, and revalorisation. The primary purpose of these business case is to identify opportunities to minimise textile waste, including recycling, upcycling, and reuse measures for factories in HIE.

Business Case 1:	**Investing in Material Efficient Technology and Software**
Business Case 2:	Mechanical Recycling for Industrial Symbiosis
Business Case 3:	Mechanical Recycling for Fibre-to-Fibre Yarn Production
Business Case 4:	Chemical Recycling for Fibre-to-Fibre Yarn Production
Business Case 5:	Upcycling with Social Entrepreneurs

BUSINESS CASE 1 RATIONALE

The **business case on material efficient technology and software** reduces textile waste at the source, i.e., through the prevention of cutting waste. The implementation of the business case leads to moderate environmental benefits through reduced waste generation and avoiding further processing of waste. However, the implementation of state-of-the-art technologies and software requires financial investments.

DESCRIPTION OF BUSINESS-AS-USUAL

CURRENT WASTE HANDLING PRACTICE

	Textile waste is included in the Waste Management Framework Law No.16 of 2020 which regulates solid waste management in Jordan. Any establishment which generates more than one thousand tons of non-hazardous waste shall set a waste management plan. The plan requires the planning and implementation of precautionary measures and procedures to prevent or reduce waste generation which must be submitted to the Ministry of Environment.
	Cutting waste accounts for around 70%[1] of the overall waste of garment manufacturers in HIE. Only few waste minimisations measures have been adopted so far. In factories with higher production volumes, AutoCAD optimization software is utilized for optimal fabric yield. One factory in HIE implemented Seamless Knitting Technology where yarn is used to knit the whole garment, generating minimal waste.
	The factories in HIE do not sort the cutting waste according to different colours and types of fabric. The textile waste is collected by trucks from a private contractor and transported to Al Ekeider Landfill, where it is landfilled in the area designated for textile waste.

COSTS OF CURRENT WASTE HANDLING MODEL

- Waste pick-up and landfilling costs: 4 JOD per ton of textile waste

FINANCIAL RISKS OF CURRENT WASTE HANDLING MODEL

- Penalties for noncompliance with current waste management regulations
- Increasing costs of waste handling and transport, e.g., closing of Al-Ekeider landfill for textile waste
- Costs of compliance with export market laws (e.g., EU supply chain due diligence)
- Opportunity loss due to high prices of raw materials which is being wasted

[1] As per the survey results in the study on garment waste materials reduction and their revalorization potential, developed by GIZ on behalf of BMZ

DESCRIPTION OF BUSINESS CASE 1

NEW WASTE HANDLING PRACTICE

Introduction of material-efficient technologies and software to reduce textile waste generated during production. According to the American Association of Textile Chemists and Colourists (AATCC), around 10 – 25% of the fabric input is usually wasted as fabric trims. At the HIE, a similar percentage of textile waste, approx. 23% is produced, of which 70% stems from the cutting waste. Two material-efficient technologies are introduced below:

1) CAD Cutting Optimization

CAD Cutting Optimization increases design accuracy during the design process and creates digital pattern making that allows manipulating the pattern several times without wasting resources and grading. This optimizes the cutting process and reduces the amount of cutting waste. Using innovative patterns or performance techniques such as CAD pattern making is much more efficient as it allows the user to compare different markers during the process before selecting the final one. In addition, skilled operators and good maintenance and housekeeping will not only create new job opportunities but also help minimize the waste production even further.

2) Seamless Knitting Technology

Seamless Knitting Technology has the capability to produce ready to wear garments without any lateral seams, as it eliminates the seam production (cutting and sewing). In addition, it minimizes the risk of defects and damages resulting in almost zero fabric waste. This technology is only relevant for factories that use yarn instead of fabric as input material. The Seamless Knitting Technology produces the garment in one step, without intermediary fabric manufacturing, fabric cutting and sewing steps, this in turn results in almost zero fabric waste.

Practice Example

A jeans company that joined the SwitchMed Programme's MED TEST II[2] relied on manual cutting. This setup led to a potential of unoptimized patron arrangement for cutting. The loss resulting from the baseline setup was around 15%, 70% of which was lost during the cutting process. By improving the computerization of the marker development (the drawing of the pieces and the cutting which cut several layers of fabric at a time) the waste was reduced, leading to 2% increase in raw material utilization. This was equivalent to 16,620 m of cloth (7 tons of cloth) with a cost saving of 29,100 Euro.[3]

[2] Industry Service Providers in the Mediterranean - SwitchMed MED TEST https://switchmed.eu/industry-circular-economy-practice/

[3] Source: RECP Best Practice Catalogue https://www.test-toolkit.eu/wp-content/uploads/2019/10/Improved-CAD-cutting-.pdf

BENEFITS FROM IMPLEMENTING MATERIAL EFFICIENT TECHNOLOGY

Using material-efficient technology will improve production and process efficiency while improving the quality of the final product, resulting in better outfits' qualities that can be sold at higher prices and in return increase revenues. In addition, it will reduce waste, service costs for waste pick-up and disposal, which will improve energy efficiency. Material efficient technologies have therefore economic but also environmental benefits which can be summarized as follows:

- Reduced material input due to increased material efficiency
- Reduced material output (waste) by around 0.23 tonnes per day
- Decreased energy input per unit of product and consequently reduced carbon footprint
- Annual reduction of around JOD 335.8 service costs for waste pick-up and disposal
- Decreased CO2 emissions and soil pollution due to less landfilling
- Better compliance/due diligence performance
- Better corporate social responsibility performance

	Value per unit (JOD)	Number of units	Total annual benefit (JOD)
Cost savings on textile waste transportation to landfill	4	0.23 tons per day	335.8 (4 x 0.23 x 365 days)
Cost savings on raw material textile	2.94 JOD/kg	1,000kg	246,740 (0.23 x 2.94 x 1,000 x 365 days)
Total annual benefit (JOD)	-	-	**247,075.8**

COSTS

- Capital and operating costs for acquiring new technology.
- Available technologies in Jordan:
  - Orfali CAD technology (made in China)
  - CAD technology "Rich Peace" (Japanese Brand)
- Capacity building (training costs) is included in the price and will be provided by the supplier.
- Maintenance parts are available and sold for market prices.

Item	Cost per unit (JOD)	Number of units	Total cost (JOD)
CAPEX (Capital expenditure) and OPEX (Operational Expenditure)			
CAD Machine including training costs	88,000	1	88,000
Total costs for first year	-	-	88,000

ENABLING FACTORS

1. The new national solid waste management framework requires the implementation of precautionary principles to avoid the generation of waste.
2. There are impact investment funds which may provide financial support in the form of loans and quasi-equity investments (Amam Ventures, EBRD).

Amam Ventures	Investments in impactful, commercially viable SMEs with a track-record, which identifies an expansion opportunity and need risk capital to grow. Investments through quasi-equity instruments are entrepreneurial friendly and fair. Tickets start at $250,000 up to $2million. www.amamventures.com/funding
EBRD (Green Economy Financing Facility)	Supports Jordan businesses to invest in high-performing technologies by providing financing through local participating financial institutions. www.ebrdgeff.com

IMPLEMENTATION ROADMAP

SHORT-TERM (1 YEAR)	KPI	Timeline	Cost Incurred
Assess waste minimization potential	Waste minimisation assessment completed	Y1 Q1	Yes
Develop strategy of waste minimization and technological requirements	Waste minimisation and technological requirements strategy developed	Y1 Q1	Yes
Develop feasibility study, calculating CAPEX and OPEX as well as generated cost savings	Feasibility study conducted	Y1 Q2	Yes
Identify potential investors to fund equipment purchases	List of equipment funding investors	Y1 Q3	No
Allocate and acquire initial CAPEX	Secured CAPEX	Y1 Q4	No

MID-TERM (2-3 YEARS)	KPI	Timeline	Cost Incurred
Invest in in-house waste minimisation technology	Operating material-efficient technology	Y2 Q1	Yes
Dedicate (and train) personnel to continuously drive waste minimisation	Specialized staff in waste minimisation solutions trained or hired	Y2 Q1 – Y3 Q4	Yes
Monitor performance in terms of waste minimisation and cost savings	Monitoring & evaluation plan developed and implemented	Y2 Q2 – Y3 Q4	Yes
Develop marketing strategy	Marketing strategy developed	Y2 Q2 – Q3	Yes

LONG-TERM (5 YEARS)	KPI	Timeline	Cost Incurred
Increase visibility of measures (e.g., join waste initiatives)	Member of a waste initiative	Y5 Q1	No
Implement marketing strategy	Marketing strategy implemented	Y5 Q1	Yes
Increasing selling prices of "zero waste goods"	Revenues increased by 5%	Y5 Q2	No

CONCLUSION

Business Case 1 recommends the application of CAD cutting technologies which reduce the amount of cutting waste up to 48 tons annually and costs associated with transporting and disposal. CAD cutting optimization requires less material input due to increased material efficiency and can increase the utilization of raw material by 2%. Furthermore, it supports in estimating fabric consumption which reduce the excess of fabric quantities. The seamless knitting technology is only relevant to produce knitted wear but reduces cutting waste to almost zero. Business Case 1 should have priority for implementation as it reduces waste at source and improves material efficiency. The technology and/or software requires an initial capital investment.

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