



RECYCLING IN TEXTILES

HAMK University of Applied Sciences
Supply Chain Management

Artjom Roznev

Ekaterina Puzakova

Frank Akpedeye

Isabella Sillstén

Olakunle Dele

Olatunji Ilori

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1 TEXTILE RECYCLING

Textile waste can be classified as either **pre-consumer** or **post-consumer** textile waste. Pre-consumer textile waste is the leftovers or by-products from textile-, fiber- or cotton industries. Post-consumer textile waste is the waste of fleece, flannel, corduroy, cotton, nylon, denim, wool, and linen, which have already passed through the consumer market and are recycled and re-constituted into a product for the consumer market once again.

Textiles in landfill biodegrade to form methane gas which is released into the air and is not suitable for human consumption, which is one of the most effects, that recycling is addressing by diverting textile from landfill.

2 TEXTILE RECYCLING IN THE WORLD

“The environmental benefits gained from using recycled raw materials rather than virgin materials to make these products include conservation of natural resources as well as reduced energy consumption, carbon dioxide (CO₂) and other emissions, and waste going to landfills”, according to TextileWorld.com.

"There's been a fundamental change in our culture when it comes to recycling and sustainability," remarked William L. Jasper, president and CEO of Greensboro, "The younger generation thinks about it differently than the older generation. It's really much more important now, and it's going to continue to be. People are starting to recognize there is only so much landfill space and only so much oil."

3 TEXTILE RECYCLING IN THE UNITED KINGDOM

3.1 Recycling

Salvation Army trading company ltd is a logistic company base in the UK having collaboration with Kettering textile for the sole aim of recycling textile. It was established in 1991 with over 5,000 network recycling textile and also 100 charity shops national wide. (Salvation Army Trading Company www.wear2bank.co.uk/why-recycle/what-to-recycle)

3.2 Caring for the Environment

Salvation Army is one of the leading companies in the collection of textile for recycling in the United Kingdom and the republic of Ireland, They provide the experience of a business with financial stability to ride of difficult market situation.

Textile is the fastest growing waste in the UK ever generated and the landfill is almost going out of use hence the salvation army has be able to recycle 99% of the textile leaving only 1% which cannot be use to the landfill. (Salvation Army Trading Company www.wear2bank.co.uk/About-us/Environmental-credentails)

3.3 Collecting cloth

Salvation Army has devised different ways of collecting use textile around UK.

BANK, With over 5,000 clothing bank in car packs and other recycling centre all over UK, use clothing are easily collected. The banks are empty regularly by team of local collector which are later transported to the ware house for sorting.

DOOR-TO –DOOR, This is the method of personal contact, over 400,000 bags are distributed to resident every week and collected back from them on a specific date. These bags are collected with vehicles having logo for recognition. More clothing are collected from door-to-door as compare to clothing bank.

WHY RECYCLING, throwing away cloths is not only wasteful but harmful to the society. Textile, linen and rags can be recycled. After sorting out the good ones, the others are sent to shredding to make mattress filling, insulation and soundproofing for

cars. (Salvation Army Trading Company – Clothing Banks
<http://www.wear2bank.co.uk/Clothing-Collection-Scheme/Clothing-Banks>)

3.4 Statistics

90% of clothes purchases in UK are imported.

The UK buys 2,066,000 tonnes of clothes worth over £34,000,000,000 each year.

A 52% or 1,081,000 tonne is thrown away in landfill.

On average, each UK resident buys around £600 of clothes each year and discard £300 worth.

The textile waste material industry is more like mining company.

Textile waste material industries include shoddy producer, laundry and wiping rag producer, clothing sorted, shredders and garnet

Garneting, this is a process of recovering the fibres from hard twisted waste, rags and chippings. The materials are returned to a fluffy fibrous condition so it can be reused in blends.

The process of garneting is the use of machine, listed below are the process:

1. Used sweater to be sorted
2. Cutting out the labels
3. Bags of labels been made into shoddy
4. Bale of sweater arrange
5. Loading to chopper
6. First stage of chopping/ garneting
7. Each stage of garneting uses finer-toothed mesh
8. Fibrous stage
9. Removing the button
10. Web of fibre
11. Spinning the yarn
12. Preparing yarn for weaving
13. Bolts of yarn

- 14. Weaving
- 15. Finishing the blankets
- 16. Finished blankets

(ATID Sustainability Research lab – http://www.k-state.edu/atid-sustainability/Initiatives/TexRecycle_Home.html)

STATISTIC-TABLES:

Salvation Army trading company co and Kettering textile did a sampling survey of textile bank in England and Wales

QUALITY	DONATIONS in KG	PERCENT OF TOTAL
Wearable	31.400	71.3
Recyclable	9.800	22.3
Rubbish	2.800	6.4
Totals	44.000	100

TABLE 1

Local Authority kerbside scheme

The research also shows that between 10% and 15% of 450 local Authorities in the UK are involve in textile collection.

LOCAL AUTHORITY	NUMBER OF HOUSEHOLD	TONNAGE COLLECTED PER ANNUM	RETURN RATE KG PER HOUSE HOLD
Waltham	79,000	60	0.8
Sefton	123,000	240	1.9

Stoke on trend	106,000	322	3.0
Lewes	28,000	28	1.0
Totals	336,000	650	1.9

TABLE 2

3.5 Textile Reuse and Recycling

It was estimated that the 324,000 tonnes collected in the UK, between 60% and 70% are re-used as clothes; almost all of them in the markets other than the UK. The statistics show that 199,500 tonnes of used textiles were exported in 2004 from data gather, it was estimated that the average sale price for one tonnes of sorted product (both reusable and recycling grades) over few years is approximately £400 per tonne.

DISPOSAL ROUTE	SATCOL (2003)%	TRA (2005)%	SATCOL (2005)%	AVERAGE (2005) SATCOL/TRA%
UK-RE- Use	71	3	3	3
Export RE-use		63	55	60
Wiper grade	8	10	14	12
Recycling grade	15	18	21	19
Waste	6	6	7	6

TABLE 3

3.6 Recycling Target & PRNS

Approximately 75% of clothing items are not collected, unlike packaging glass and metal cans, the heterogeneous composition of the waste stream implies that there is

currently little value in the 75% of clothing that is not collected. Setting target at a higher level will tend to draw in higher quantities of lower quality used clothing and other textiles and increase the cost of collection and sorting. (Salvation Army Trading Company www.wear2bank.co.uk/why-recycle)

A research conducted in UK in the year 2003 by DEFRA estimated that waste from textile and other clothing went from 1.4million tons to 2.35million tons, which stand as 1.2million tons of textile been dispose as waste with an additional net of amount 324,000 tons collected by secondary textile industry for reuse or recycling.

In 2008, Textile collected for recycling grow from 324,000 tons in 2003 to 523,000, an increase of 13% while the total volume of discarded municipal waste increased by 8% but plans are on to reduce the waste to 0% as possible.

Statistic value available as at 2003:

54% exported for reused overseas.

13% Re-used in the UK.

19% Recycled in the UK.

8% Recycled overseas.

6% Dispose in landfill.

(Lontex exports Ltd)

(LE - Recycle <http://le-recycling.com/index.php/recycling/>)

4 Textile Recycling in the United States

Textile waste can be classified as either **pre-consumer** or **post-consumer**. Pre-consumer textile waste is the leftovers or by-products from textile-, fiber- or cotton industries. Volume of recycling pre-consumer textiles is 75%; this means that every year 750 000 tons of this waste is reused as a raw materials. It is used in automotive-, furniture-, home furnishings-, mattress-, coarse yarn- , paper- and other industries.

Post-consumer textile waste is the waste of fleece, flannel, corduroy, cotton, nylon, denim, wool, and linen, which have already passed through the consumer market and are recycled and re-constituted into a product for the consumer market once again. The textile recycling industry annually prevents 2.5 billion pounds of postconsumer textile product waste from entering the solid waste stream, according to the Council for Textile Recycling. This number represents 10 pounds of post-consumer textile waste for every person in the United States.

(EPA – United States Environmental Protection Agency <http://www.epa.gov/>)

4.1 Recycling Textiles in the USA

More than 2 000 textile recycling companies handle the stream of post-consumer textiles in the United States; this industry employs approximately 10 000 workers at the first level of processing materials. It also employs 7 000 workers at the final processing level.

According to Solid Waste District of LaPorte County: “Approximately 500 million pounds of textiles collected are used by the collecting agency, with the balance sold to textile recyclers, including used clothing dealers and exporters, wiping rag graders, and fiber recyclers. Most textile recycling firms are small, family-owned businesses with fewer than 500 employees. The majority employ between 35 and 50 workers, many of whom are semi-skilled or marginally employable workers.” (Solid Waste District LaPorte County <http://www.solidwastedistrict.com/index.html>; Secondary Materials and Recycled Textiles Association <http://www.smartasn.org/textilerecycle/facts.pdf>)

In factories, workers separate overly worn or stained clothing into many categories. Textiles might end up as wiping or polishing cloths, some cotton waste can be made into rags or high-quality paper, knitted/woven woolens can be undone into fibrous (used in low-grade applications like insulation or seat stuffing), buttons and zippers can be reused; after all, at the end of the process, leftovers are just 7 %- 5 % from the total reused waste. So textile recycling companies can recycle 93 %- 95 % from the waste the process. The leftovers are non-hazardous natural materials, which can be composted. (Solid Waste District LaPorte County <http://www.solidwastedistrict.com/index.html>;

4.2 Logistics and Collecting

According to an estimate from the Council for Textile Recycling, almost half of the disposed textiles are delivered or given to charities. This means that the huge part of the population in United States, prefer giving the clothes away to charities. Charities usually give the clothes away, sell them with lower prices in flee-markets/second-hand stores or the textiles are exported to foreign countries. Unsalable clothing is sold to textile recovery facilities for processing.

When thinking of charity or donation of the textiles, half of the US people making donations prefer door-to-door pickups. The survey is made by one of the largest textile collectors Goodwill Industries. They also discovered that more than half of the donating people wouldn't go further than 10 minutes way to make a drop off.

Usually textiles and clothes are not sorted at the point of collection. It is still needed to keep them clean and moisture-free, because otherwise they cannot be sold for reuse. To prevent these incidents, many charity organizations offer closed drop off-boxes.

4.3 Statistics:

STATISTIC OF RECYCLED POST-CONSUMER TEXTILE PRODUCT WASTE			
	Domestic	Export	Total
Used clothing	-	35 %	35 %
Fiber for reprocessing	7 %	26 %	33 %
Wipers	25 %	-	25 %
Landfill	7 %	-	7 %
Total:	39 %	61 %	100 %

TABLE 4: Statistic of recycled post-consumer textile product waste in the USA

(SMART - Secondary Materials and Recycled Textiles

<http://www.smartasn.org/textilerecycle/facts.pdf>)

While a few communities have textile recycling programs, about 85 percent of this waste goes to landfills where it occupies about 4 percent of landfill space.

	2001	2004-2005	2009
Textiles generated	9,8 million tons		12,7 million tons
% of total municipal solid waste	4 %	5 %	5,20 %
Post consumer textiles recovered export or for reprocessing		15,30 %	30,90 %
Recovery rate for all textiles			14,9% / 1,9 million tons

TABLE 5: Numbers of recycled textiles in past 10 years in USA

(SYSTEMS ANALYSIS OF TEXTILE RECYCLING, Jana Hawley smartech.gatech.edu/bitstream/handle/1853/10809/9th_3_hawley.pdf; http://en.wikipedia.org/wiki/Textile_recycling)

5 RECYCLING IN RUSSIA

There is a huge amount of resources (textile and domestic wastes) in Russia which are processed and used as recyclable materials. At the end of 80s procurement of recyclable materials was more than 100.000 tons per year.

Textile is of the most common types of wastes in Russian Federation. Due to statistics of year 2005:

Formation of textile per year:	Level of using of processed textile:
0,37 million of tons	50,4%

State Standards of Russian Federation gives a definition what can be considered as textile wastes, 'sorted cotton, consisted of being already used textile products, nonwoven, knitted, wattle, quilted fabrics which are manufactured from cotton and cotton mixed with chemical fiber and are assigned for processing companies' (ГОСТ 4643-75). All those materials are used in producing outdoor, furniture, floor covering, cuddly toys for kids, mattresses, pillows and so on.

Textile manufacturing in Russia will be described based on example of one company named ZAO "ZavodTver'Mash". It is one of the biggest and oldest companies in Russian Federation. It was established in times of Soviet Union and it is situated in city Tver'.

Processing recyclable materials (woolen cloth, flax, and cotton), chemical fibres (synthetic and artificial) and mixes of them are gone through garneting in order to get regenerated fibres for manufacturing of nonwoven and other materials. Different types of machinery are used for:

- woolen and half-woolen (equipment ИЦМШШ-1)
- Nonwoven and synthetic materials (equipment ШЦ-850, МШЦ-1).

Moreover, factory produces machines for primary processing of woolen cloth and machines for scotching of rough and half-rough fibres.

(Internet Portal "Resyclers.ru".2011. ZAO "ZavodTver'Mash" [online].
<http://recyclers.ru/modules/section/item.php?itemid=229>)

So that equipment could be in use for a longer period of time the company manufactures feeder П-1 which carries out blending of raw materials, uniform supply and trapping of metal objects. In order to transport fibers between separated parts of opening and lap-forming machine and partly abandon it from dust and small dirt foreign substances, machinery for woolen cloth processing are completed with high-speed condenser. In a place of work where line is situated filters ФТ-2М or ФР-6П are installed for cleaning of air inside the building.

Experience of various enterprises and an organization where such equipment has been installed shows high cost-effectiveness and profitability using minimum costs. A cost of initial raw materials is 10-15% of final product. However, the most important issue here is low energy consumption and small number of maintenance staff (only 3 people) what is achieved due to allocation of equipment into one engineering line. Low prices of machinery that is included into engineering line allow compensating all costs within short period of time (1, 5 -2 years).

Taking part in industrial exhibitions, different kinds of advertising and publications in specialized magazines help to link connections with textile and wool-processing factories which once have been lost. Nowadays company improves relations with Belorussia, Kazakhstan, Moldavia, Tatarstan, Saint-Petersburg and Moscow. (ZAO "Otraslevie Vedomosti" 2007. Textile Wastes [online]. <http://www.solidwaste.ru/processing/catalog/view/30.html>)

6 RECYCLING IN AUSTRALIA

6.1 The Smith Family Commercial Enterprise

The Smith Family's Commercial Enterprise located in the Sydney suburb of Villawood is a manufacturing facility that was established in 1987, as a means of utilizing textile industry waste and the tons of surplus clothing that weren't suitable for either sale through TSF's retail outlets or for export. The first of three specialized lines went into operation to produce nonwoven fabrics from regenerated fibers. Carpet underlay, furniture removal felt, weed suppression and water retention felts are just some of the examples of products produced by the manufacturing line. Through the creative and innovative commercial utilization of what would otherwise be waste product destined for landfill, TSF is able to convert hundreds of tons of waste clothing and material into manufactured non woven textile felts and fabrics. In 1992, a significant investment was made and the second manufacturing line became operational enabling the Commercial Enterprise to significantly expand its capabilities and manufacture a more extensive range of felt and fabric products. In 2004, as the result of a strategic business review and the support of the Federal Government's Strategic Investment Program, TSF invested in

the growth potential of its nonwoven textile operation and committed to an additional manufacturing line that would increase the output capacity by 6,000 tons annually to over 10,000 tons annually from the Villawood operational centre.

6.2 Goals

It's their goal to use technology and innovation to efficiently and responsibly transform materials and resources many regarded as waste, into marketable products that benefit the Australian economy and environment. The long term societal benefit is also important because it means the Commercial Enterprise can contribute funds to enable TSF's Social Enterprise to support more Australian disadvantaged children and help them reach their potential through education. The potential to increase the use of text source of fiber for recycling is derived from the TSF Clothing collection & sorting operation. There exists a healthy international market for post consumer textile waste. In Australia the two relevant tariff codes are as follows: 63090010 the description for which is "Worn clothing", and 63090090 the description for which is "Worn textile articles, excluding clothing" which includes shoes, handbags etc.

6.3 Statistics

The Australian Bureau of statistics records that in the above two tariff categories, approximately 50,000 tones is exported annually to 44 countries, most of which are in the third world. This equates to around 2,500 40 foot shipping containers. The major destination is the United Arab Emirates, no doubt for transshipment to gulf countries. Malaysia is the second largest importer of textile waste from Australia, with Pakistan and New Guinea running third and fourth. African nations such as Togo, Tanzania, Mozambique, Nigeria, Tunisia, Dem Rep of Congo, Zaire, Zambia, Benin and Malawi and all large emerging recipients of Australian charitable clothing donations; so too south pacific nations such as Papua New Guinea, Kiribati and Vanuatu, to name a few. Regardless of their final destination, used textiles have a relatively stable and reasonable price that, like all exports is influenced by exchange rates and larger overseas competitors. While of second hand clothing makes up a small part of global trade in textiles and clothing, for some countries it plays a more important role than for others. The trade supports hundreds of thousands of livelihoods in developing countries. These

include jobs in trading, distributing, repairing, restyling and washing clothes. Oxfam's research in Senegal estimates that 24,000 people are active in the sector in that country. 12 The major exporters of worn clothing and worn textile articles are the large charities such as the Smith Family Enterprise and Life Line. The multi faceted benefits of these exports cannot be underestimated. While ameliorating poverty in the receiving country, these shipments mitigate Australian land fill and at the same time as earning export income for Australia; the earnings for which provide Australian charities with social capital that is reinvested into welfare programs.

A representative of the Australian National Association of Charitable Recycling Organizations estimates that over 50 million kilos of textile waste is collected by Australian clothing recyclers through charity bins and donations. Much of this can be reclaimed and recirculated through charity shops or reprocessed into functional textiles. However, 12.5 million kilos are unsuitable for reclamation and is sent to landfill.

6.4 Knowledge

In order to manage an environmental issue, it must first be measured and quantified. The limited and inadequate data available in Australia regarding the amounts and types of textile waste is an impediment to intelligent and effective recovery and/or regeneration of textile waste. This paper advocates for a study to be commissioned on textile waste in Australia. Knowledge and thus solutions to the decontamination and calorific separation of noxious chemicals that may be imbedded in textiles used for industrial applications, such as filtration will only be achieved through research and collaboration between industry and research agencies.

6.5 Policy

There is limited effort to stimulate resource recovery through policy instruments that influence recycled demand and, thereby, create greater pull in the resource recovery system. On the one hand, and in contrast to overseas jurisdictions, there are very few targets, financial incentives, or mandatory requirements in terms of recycled content purchasing for public sector agencies. Some state governments have zero waste strategy targets to increase resource recovery rates within a designated time frame. To reach

these targets, these strategies should be supported by programs that utilize this waste. Regeneration verifiably reduces the environmental impact of carbon emissions, energy use and toxic chemical by up to 70%.

Certainly, investment in systematic, investigative and experimental activities that involve research, development and innovation for the purpose of acquiring new knowledge or creating new or improved materials, products, devices, processes or services to regenerate textiles will positively serve the Australian economy and reduce our environmental footprint. However, there has been limited effort to stimulate the recovery of textile waste through policy instruments. The Technical Textiles and Nonwoven Association called for support to be provided for investigating the establishment of a national carpet recycling program; and for a Cooperative Research Centre for sustainable products and plastics, including the reprocessing or depolymerization of materials to be established with the textile/carpet sector.

This included government RDI funds for converting textile and apparel waste streams into energy that can be used or fed back into the power grid. Until recently there were no formal studies on textile waste conducted in Australia, facts and figures tended to be anecdotal and reasoned from overseas studies. However, there are no definitive figures for the volume pre-consumer textile waste from fiber, textile and garment manufacturing operations, and industrial textile waste generated from commercial and industrial usage, most of which is consigned to landfill. In September 2008, the Carpet Institute of Australia completed a study of resource flows for the carpet sector in 2007 with the intention of developing industry plans to improve resource utilization efficiencies across the lifecycle of carpet from manufacture to the end of life. Particular emphasis was placed on carpet wastes as these are a prominent source of construction and demolition waste as well as commercial wastes sent to landfill. A number of waste composition studies in Australia indicate that unrecovered textile waste accounts for approximately 4 percent of the content of our landfills. These statistics are an aggregate of all sectors in the TCF industry, it means that it covers pre-consumer, post-consumer and industrial sector.

(<http://www.businesslink.gov.uk/bdotg/action/detail?itemId=1074403734&r.11=1073858799&r.12=1087350872&r.13=1074402501&r.s=sc&type=RESOURCES>)

7 TEXTILE RECYCLING IN NIGERIA

The collection of cloths are done house to house and door to door by some certain people which pay money in returns to the cloths owner according to how new and valuable their cloths are. There are many ways of recycling used cloth in Nigeria and we will elaborate on some that are to our best knowledge because majority of Nigerian used cloths are been recycled using local methods.

Dying of used cloth- Tie and dye is a method of recycling used cloth in Nigeria, it is a method whereby used cloth are been transformed into a new one via dye. The dye is prepared with hot water and some chemicals then the used cloth is poured into the hot dye of different colors depending on the user's choice. After bringing out the cloth from the dye, the cloth is spread or hangs to dry then the cloth wears a new look. In order to eradicate the problem of used cloth littering the ground, tie and dye is encouraged in Nigeria. Also, jeans trouser can be dye to different colors for example from blue to black and so on.

Using of used cloth in making school bags for both primary and secondary school students for example; using jeans materials in making school bags, hunter's bag and dusters for student in cleaning their blackboard.

Indigo dyed cloth commonly produced by Yoruba Women of south western Nigeria (Abeokuta and Ibadan) people to be precise called Adire cloth. Adire is also called tie and dye. New ways of resist dyeing were formed; the one which cassava starch is used to make some hand-painting designs on the cloth before dyeing is called Adire Eleko. Method of making Adire: a used guinea cloth is been put into the hot dye and the cloth will be tied in different part properly some designs are made on the cloth also before it is been put into the hot dye, to bring out another design that will make the cloth looks good and new.

(Adire African Textiles <http://www.adireafricantextiles.com/adireintro.htm>)

8 TEXTILE RECYCLING IN INDIA

8.1 Textile Recycling Initiative in New Delhi by Goonj

This foundation was found by Ashoka Fellow Anshu Gupta, the GOONJ project operates by gathering clothing which are unused from across India to subsequently recycle the materials to provide clothes, sanitary as well as some other basic amenities to people who live in communities which are poorer all over the country.

(Inhabitat Media – The Goonj Project: Textile recycling initiative in New Delhi
<http://inhabitat.com/goonj-recycling-textiles-in-new-delhi/>)

8.2 Modes of operation

They have in their service over 300 volunteers and mass participation of both individuals and organization both governmental and non-governmental e.g. housewives, professionals, schools, colleges, corporates, exporters, hotels and hospitals supporting the recycling and redistribution center acting as channels in helping to send out about 20,000 KGs or more of recycled waste materials monthly. A large network chain of more than 100 grassroots agencies is also lending out helping hands to GOONJ in their Bid to reach parts of many states of India.

(Inhabitat Media –The Goonj Project: Textile recycling initiative in New Delhi
<http://inhabitat.com/goonj-recycling-textiles-in-new-delhi/>)

8.3 Textile Recycling By the Kishco Group

Recycling of textile has been a major area for Kishco. Items in this category are both imported into India and exported out of India to serve various industries. These materials are made up of residues of all types (cotton, acrylic, wool, polyester, nylon etc.)

(Kishco group <http://inhabitat.com/goonj-recycling-textiles-in-new-delhi/>)

8.4 Method Used

This could also be in the form of used clothing waste (rags). "This comprises normally wool, acrylic and cotton sweater as also other woolen materials (wool bodies) such as

overcoats, jackets, skirts, pants etc which are converted into re-generated fibre/rags for manufacturing of charity blankets. This items can be brought into India in mutilated condition only, if it is in un mutilated condition then it can only be brought in by licensed companies in the free trade zone or by 100% export oriented units. Some of the cotton used clothing waste imported into India is also used within the cleaning industry as wiping material. (The Kishco group online portal <http://www.kishcogroup.com/textile.html>)

8.5 Import and Export

Supplies mainly come in from U.S.A. and Europe."

Talking about export, this aforementioned organization, Kishco, is also shipping large quantities of polyester re-generated fibre example of which is poly sliver, poly yarn waste etc. in bright/semi-dull etc. Also nylon is being exported to Europe for the manufacture of non-woven fabric.

(Kishco group <http://www.kishcogroup.com/textile.html>)

There is in the business of waste clothes some dynamics which are involved also, as this is a price sensitive item, it goes in a bi-directional manner meaning there are times when it is exported out of India whereas at other times it can be imported into India - this could be in the form of fibre waste, yarn waste, sliver waste, noil waste etc.

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