ECONOMIC FEASIBILITY STUDY FOR PAPER WASTE RECYCLING PROJECT

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ABSTRACT

The aim of this study is to investigate the economic feasibility of paper recycling factories in Iraq by studying the technical, marketing and financial feasibility to establish a paper-recycling factory in Najaf Governorate and to show the importance of these projects in achieving sustainable efficiency as well as achieving economic efficiency. The expected investment and operating costs were estimated and then the economic profitability criteria were adopted in addition to conducting a sensitivity analysis and determining the break-even amount. The research hypothesis was proven, which confirms that there is an economic, an environmental and marketing feasibility for paper waste recycling projects, as it was found that the project recovers all the money invested in it within a year and a month and a half, and the accounting return rate reached 82%. The net present value was (78,403,069,418) Iraqi dinars, while the discounted profitability index criterion was about (2.546). The internal rate of return criterion was (115%). The risk analysis proved that the project can withstand a 60% decrease in its revenues, and the break-even point quantity was about 1729 tons. The sensitivity analysis also proved that the project is insensitive to changes in investment costs and operating costs, and insensitive to fluctuations in the prices of the project's products. In light of the results, it was found that the project is economically feasible. The study recommended the need to support waste recycling projects as they contribute to achieving environmental sustainability and economic efficiency.

Keywords: sustainability, evaluation, net present value, sensitivity analysis, break-even

دراسة الجدوى الاقتصادية لمشروع إعادة تدوير النفايات الورقية

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المستخلص

هدف البحث الى بيان الجدوى الاقتصادية لمصانع اعادة تدوير الورق في العراق، من خلال اعداد دراسة جدوى فنية وتسويقية ومالية لإنشاء مصنع اعادة تدوير الورق في محافظة النجف الاشرف، وبيان اهمية هذا المشاريع في تحقيق الكفاءة المستدامة فضلا عن تحقيقها الكفاءة الاقتصادية، وقد تم مناقشة مراحل دراسات الجدوى الاقتصادية للمشروع وتقدير المنافع المتحققة من المشروع وتم تقدير التكاليف الاستثمارية والتشغيلية المتوقعة ومن ثم اعتماد معايير الربحية الاقتصادية فضلا عن اجراء تحليل الحساسية وتحديد كمية التعادل، وقد تم اثبات فرضية البحث التي تؤكد بان هناك جدوى اقتصادية وبيئية وتسويقية لمشاريع اعادة تدوير المخلفات الورقية، اذ تبين ان يسترد المشروع كامل الاموال المستثمرة فيه خلال سنة وشهر ونصف، وبلغ معدل العائد المحاسبي 82% ويعكس ربحية المشروع المرتفعة جدا، وقد تبين ان صافي القيمة الحاضرة بلغت (78,403,069,418) دينار عراقي، فيما بلغ معيار دليل الربحية المخصوم نحو 2.546، كما بلغ معيار معدل العائد الداخلي (115%) ، مما يظهر مدى جدوى للاستثمار في هذا المشروع، اثبت تحليل المخاطر ان المشروع يتحمل انخفاض ايراداته بمقدار 60% ، وقد بلغ كمية نقطة التعادل نحو 1729 طن ، ، كما اثبت تحليل الحساسية ان المشروع غير حساس للتغيرات لتغيرات في التكاليف، وتبين في ضوء النتائج ان المشروع مجدي اقتصاديا ، وقد اوصى البحث في ضرورة دعم مشاريع اعادة تدوير النفايات كونها تسهم في رفع الكفاءة المستدامة فضلا عن تحقيق الكفاءة الاقتصادية.

الكلمات المفتاحية: الاستدامة، التقييم، صافي القيمة الحالية، تحليل الحساسية، نقطة التعادل.

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INTRODUCTION

Recycling can be defined as the process of remanufacturing and making good use of waste, whether (domestic, industrial, agricultural), as it allows us to remanufacture newspapers into cardboard plates or remanufacture old metal cans to provide new cans and thus reduce their accumulation in the environment. This process is done by classifying and separating waste based on the raw materials in it, then remanufacturing each material separately (17). The environment represents the framework in which man lives, and in which he exercises all activities of daily life (27). The process of recycling paper waste is the process of remanufacturing and using paper waste, as used paper is collected from institutions, schools and organizations and sent to paper and cardboard factories that work to remanufacture and sell it on the local market or global markets. This, of course, saves cash by reducing the rate of paper consumption, in addition to providing the quantities of paper that the market needs in a short time. Paper recycling is a series of processes that convert used paper into new materials that can be used again. The shortage of basic materials and human need has created a desire to invent ways to cover or reduce this shortage. The need for rubber, plastic and paper pushed people to the idea of recycling to save and make good use of these materials, and reduce waste, and preserve the environment. The idea began during the First and Second World Wars, due to the pollution left behind, and the large amount of scattered waste, as these wastes were collected for reuse, and over the days, the recycling process became one of the most important methods used in managing solid waste due to its environmental benefits. The programs and campaigns carried out by environmental associations played a major role in expanding the general thinking about recycling due to its great importance and welcomed by school students, and even homemakers and members of environmental associations. Direct recycling was considered a basic form before the nineties, but with the beginning of the nineties, the focus began on indirect recycling, which improves the manufacturing of waste to produce other materials that depend on the same raw material such as recycling paper and cardboard, plastic, metals, especially aluminum, and more.(17) Iraq is lagging behind environmentally and suffers from multiple environmental problems and the lack of paper recycling plants which increases the cost of paper in the market, in addition to the environmental damage resulted by waste. Therefore, the aim of the research is to prepare an economic feasibility study for paper recycling that contributes to being an investment opportunity that addresses this problem. It contributes to meeting the local market's need for cardboard paper, and thus contributes to supporting the national economy by reducing the imported quantities of this product, especially in Iraq, which is considered one of the countries that consume large quantities of cardboard paper in various fields, with import rates that may reach about 11,000 tons annually over the next ten years, at a rate of about $ 1,720 per ton, due to the strength of cardboard paper to withstand shocks and its resistance to tearing, despite the fact that plastic sometimes replaces paper in the packaging process, paper is still used extensively for this purpose, which calls for attention to this industry because it is one of the important industries that most other productive industries rely on in packaging(15).

MATERIALS AND WORK METHODS

Marketing feasibility study: The market status of the project is discussed as follows:

First: Paper waste: The Table (1) shows that the amount of paper waste production in Iraq has reached about 1.2 million tons during 2010-2021 with an average of 108 thousand tons. Growth rate of about 36% was recorded due to increased awareness of the importance of recycling paper waste and increased local and global demand for paper waste. The year 2021 recorded the highest production rate of about 205 thousand tons, during which about 85 thousand tons were exported in the same year, which constituted about 41% of Iraq's production at an average price of about $ 126 per ton. Therefore, we conclude that paper recycling will contribute to raising the added value of manufactured paper converted into Kraft paper, as local production of paper waste will cover the factory's needs for paper waste as a raw material in the Kraft paper industry, as the capacity of the project to be

established is about 65 tons / day, and the daily production of paper waste in Iraq is about 561 tons / day. With only 50% of the production, the daily factory can cover about 23% of the wastepaper market volume, which can be raised to about 46% if the factory operates in two shifts. The factory will also contribute to raising the added value of the final product, as the prices of manufactured paper can reach about 800 tons, an increase of about $ 673 per ton, meaning that the percentage of increase in remanufacturing will reach about 530% based on 2021 prices. Accordingly, there is a marketing feasibility in terms of the availability of raw materials in the paper industry, in addition to raising the added value of the final product.

Table 1. Quantities of paper waste produced, imported and exported in Iraq for the period (2010-2021)

Year	Production Ton	Import Quantity Ton	Import Value 1000 US$	Export Quantity Ton	Export Value 1000 US$
2010	6000	460	84	333	173
2011	6000	59	30	2138	442
2012	17000	59	30	17475	2893
2013	29000	1	0	28536	3901
2014	26000	59	24	26280	4124
2015	65000	27	54	64976	8995
2016	140000	1211	695	138103	19657
2017	205000	71	16	201689	32864
2018	190000	71	16	184989	23236
2019	205000	69	19	120143	13863
2020	205000	6	1	85720	10842
2021	205000	6	1	85720	10842
Total	1299000	2099	970	956102	131832
Means	108250	174.91	80.83	79675.17	10986

Source: Food and Agriculture Organization of the United Nations (FAO) statistics

Printing and writing paper

The Table (2) shows that the quantity of production, imports and exports of writing and printing papers in Iraq. Imported quantities were about 332 thousand tons for the period 2010-2021 with an average of about 27 thousand tons. The growth rate was 17% due to the increase in volume and increase in local demand, as 2019 recorded the highest import rate of about 62 thousand tons, which decreased to about 29 thousand tons in 2020 and 2021 due to the Corona pandemic and the transition to e-learning, which reduced local demand for paper in its various uses. The average local production was 4,000 tons annually according to FAO statistics for the year 2022. The quantity of printing and writing paper produced and imported constitutes about 29% of the volume of paper waste produced in Iraq at the average level, as the average quantity of paper waste produced and imported was 108 thousand tons annually during the period 2010-2021, while the average quantity of printing paper produced and imported was to during the same period about 31 thousand tons annually. Therefore, we conclude that depending on recycling printing and writing paper only as raw material in the production of the planned factory will cover 66% of the factory's daily needs, as the capacity of the planned project is about 65 tons/day, and the quantity of paper produced and imported is about 86 tons/day. With considering damage rate of 50%, the quantity available for recycling can cover about 66% of the factory's needs for raw materials.

Table 2. Quantity of printing and writing paper produced, imported and exported in Iraq for the period (2010-2021)

Year	Production Ton	Import Quantity Ton	Import Value 1000 US$	Export Quantity Ton	Export Value 1000 US$
2010	4000	6004	5860	102	95
2011	4000	9577	9806	102	95
2012	4000	11568	12042	102	95
2013	4000	11317	11976	102	95
2014	4000	17936	17319	102	95
2015	4000	27340	24402	102	95
2016	4000	34052	27849	102	95
2017	4000	39307	33598	102	95
2018	4000	54057	54862	4	13
2019	4000	62493	61252	4	13
2020	4000	29433	24305	25	15
2021	4000	29433	24305	25	15
Total	48000	332517	307576	874	816
Means	4000	27709.75	25631.33	72.83	68

Source: Food and Agriculture Organization of the United Nations (FAO) statistics

Newspaper: The table (3) shows that the quantity of imported paper for journals (newspaper) in Iraq was about 12 thousand tons during 2010-2021, with an average of thousand tons, and it recorded a growth rate of 9%, as 500 tons were imported in 2021. We conclude that remanufacturing paper from journals is not feasible, as they are usually consumed in household uses and small industries, so newspapers has not been introduced as a raw material in the Kraft paper industry.

Table 3. Quantities of newsprint produced, imported and exported in Iraq for the period (2010-2021)

Year	Production Ton	Import Quantity Ton	Import Value 1000 US$	Export Quantity Ton	Export Value 1000 US$
2010	0	233	123	2	7.0
2011	0	218	167	2	7.0
2012	0	445	363	2	0.0
2013	0	1173	880	2	0.0
2014	0	2123	1470	2	0.0
2015	0	959	503	2	0.0
2016	0	493	279	2	0.0
2017	0	496	298	2	0.0
2018	0	1335	916	2	0.0
2019	0	4193	2304	2	0.0
2020	0	533	249	2	0.0
2021	0	533	249	2	0.0
Total	-	12734	7801	24	14
Means	-	1061.167	650.0833	2	1.166

Source: Food and Agriculture Organization of the United Nations (FAO) statistics

Table 4. Quantities of uncoated printing machine paper produced, imported and exported in Iraq for the period (2010-2021)

Year	Production Ton	Import Quantity Ton	Import Value 1000 US$	Export Quantity Ton	Export Value 1000 US$
2010	0	334	436	0	0
2011	0	333	356	0	0
2012	0	150	325	0	0
2013	0	644	818	0	0
2014	0	274	598	0	0
2015	0	1261	1410	0	0
2016	0	1332	2355	0	0
2017	0	516	1094	0	0
2018	0	516	1094	0	0
2019	0	1070	830	0	0
2020	0	874	1121	0	0
2021	0	874	1121	0	0
Total	-	8178	11558	-	-
Means	-	681.5	963.1667	-	-

Source: Food and Agriculture Organization of the United Nations (FAO) statistics

Uncoated Printing Machine Paper

The Table (4) shows that the quantity of imported uncoated printing machine paper in Iraq was about 8 thousand tons during 2010-2021 with an average of 681 tons and recorded a growth rate of 11%, as the highest quantity estimated at 2000 tons was imported in 2016. Considering this, we conclude that remanufacturing this type of paper is not feasible as the daily available quantity is estimated at 1.8 tons and this quantity does not cover the daily need of the factory for raw paper.

Uncoated wood-free printing and writing paper : The Table (5) shows the quantity of production, imports and exports of uncoated wood-free writing and printing paper in Iraq. The imported quantities were 254 thousand tons for the period 2010-2021, with an average of 21 thousand tons. It recorded a growth rate of about 15% due to the increase in volume and increase in local demand, as 2019 recorded the highest import rate of about 47 thousand tons, which decreased to about 20 thousand tons in 2020 and 2021 due to the Corona pandemic and the transition to e-learning, which reduced local demand for paper in its various uses. The average local production was 4,000 tons annually according to FAO statistics for the year 2022, so that the quantities produced and imported of this type of paper constitute about 23% of the volume of paper waste produced in Iraq at the average level, as the average quantity of paper waste produced and imported was 108 thousand tons annually during 2010-2021 while the average quantity of paper produced and imported of this type during the same period amounted to about 25 thousand tons annually. We conclude that relying on remanufacturing this type of paper as a raw material in the production of the planned factory will cover 53% of the factory's daily needs, as the capacity of the planned project is about 65 tons / day, and the average quantity of paper produced and imported is about 69 tons / day, and with a 50% damage rate, the quantity available for recycling can cover about 53% of the factory's raw material needs.

Table 5. Quantity of uncoated wood-free printing and writing paper produced, imported and exported in Iraq for the period (2010-2021)

Year	Production Ton	Import Quantity Ton	Import Value 1000 US$	Export Quantity Ton	Export Value 1000 US$
2010	4000	5298	5095	0	0
2011	4000	8509	8470	0	0
2012	4000	10176	10506	0	0
2013	4000	9530	9815	0	0
2014	4000	15537	14869	0	0
2015	4000	17195	15884	0	0
2016	4000	25846	20467	0	0
2017	4000	29876	24974	0	0
2018	4000	43626	40572	0	0
2019	4000	47687	49171	0	0
2020	4000	20762	16801	25	15
2021	4000	20762	16801	25	15
Total	48000	254804	233425	50	30
Means	4000	21233.67	19452.08	4.16	2.5

Source: Food and Agriculture Organization of the United Nations (FAO) statistics

Cardboard and other types

The Table (6) shows the quantity of production, imports and exports of cardboard and other types of paper in Iraq. The imported quantities were 648 thousand tons for the period 2010-2021, with an average of about 54 thousand tons. It recorded a growth rate of about 31% due to the increase in volume and increase in local demand, as the year 2021 recorded the highest import rate of about 139 thousand tons, and the average local production was 9,000 tons annually according to FAO statistics for the year 2022. This makes the quantities produced and imported of this type of paper about 49% of the volume of paper waste produced in Iraq at the average level, as the average quantity of paper waste produced and imported was 108 thousand tons annually during 2010-2021, while the average quantity of paper produced and imported of this type during the same period was 54 thousand tons annually. We conclude that depending on remanufacturing this type of paper as a raw material in production of the planned factory will cover 114% of the factory's daily needs, as the capacity of the planned project is about 65 tons/day, and the average quantity of paper produced and imported is about 147 tons/day. With a 50% damage rate, the quantity available for recycling can cover about 100% of the factory's needs for raw materials.

Table 6. Quantity of cardboard for various uses produced, imported and exported in Iraq for the period (2010-2021)

Year	Production Ton	Import Quantity Ton	Import Value 1000 US$	Export Quantity Ton	Export Value 1000 US$
2010	9000	3870	6757	4	4
2011	9000	3712	7399	29	43
2012	9000	7942	8526	29	43
2013	9000	20991	18712	29	43
2014	9000	28164	30407	29	43
2015	9000	29400	30279	133	136
2016	9000	50033	52420	21	25
2017	9000	47584	55257	21	25
2018	9000	46255	56142	21	25
2019	9000	66424	56087	84	127
2020	9000	96146	84011	37	94
2021	9000	139554	110633	37	94
Total	108000	540075	516630	474	702
Means	9000	45006.25	43052.5	39.5	58.5

Source: Food and Agriculture Organization of the United Nations (FAO) statistics

Seventh: Cardboard Paper

The Table (7) shows the quantity of production, imports and exports of cardboard paper in Iraq. The imported quantities amounted to about 111 thousand tons for the period 2010-2021, with an average of about 9 thousand tons. It recorded a growth rate of about 27% due to the increase in volume and increase in local demand, as the year 2021 recorded the highest import rate of about 111 thousand tons, and the average local production amounted to about 4000 tons annually according to FAO statistics for the year 2022. This makes the quantities produced and imported of this type of paper about 8% of the volume of paper waste produced in Iraq at the average level, as the average quantity of paper waste produced and imported amounted to about 108 thousand tons annually during the period 2010-2021, while the average quantity of paper produced and imported of this type during the same period amounted to about 9 thousand tons annually. Therefore, we conclude that relying on remanufacturing this type of paper as a raw material in the production of the factory to be established will cover 39% of the daily needs of the factory, as the capacity of the project to be established is about 65 tons/day, and the average quantity of paper produced and imported is about 25 tons/day.

Table 7. Quantity of cardboard produced, imported and exported in Iraq for the period (2010-2021)

Year	Production Ton	Import Quantity Ton	Import Value 1000 US$	Export Quantity Ton	Export Value 1000 US$
2010	4000	611	1791	-	-
2011	4000	1274	2753	25	39
2012	4000	604	583	25	39
2013	4000	1290	1741	25	39
2014	4000	2224	4997	25	39
2015	4000	4771	6442	25	39
2016	4000	9576	12350	9	10
2017	4000	10396	17272	9	10
2018	4000	5810	11741	9	10
2019	4000	4724	6280	29	84
2020	4000	11135	19162	29	84
2021	4000	11135	19162	29	84
Total	48000	63550	104274	239	477
Means	4000	5295.833	8689.5	21.72	43.36

Source: Food and Agriculture Organization of the United Nations (FAO) statistics

Paper for other uses

The Table (8) shows the quantity of production, imports and exports of paper for other uses in Iraq. The imported quantities were 386 thousand tons for the period 2010-2021, with an average of about 32 thousand tons. It recorded a growth rate of about 25% due to the increase in volume and increase in local demand, as the year 2021 recorded the highest import rate of about 52 thousand tons, and the average local production was to about 1100 tons annually according to FAO statistics for the year 2022. This makes the total quantities produced and imported of paper for other uses about 39% of the volume of paper waste produced in Iraq at the average level, as the average quantity of paper waste produced and imported was 108 thousand tons annually during the period 2010-2021, while the average quantity of paper produced and imported of this type during the same period amounted to about 43 thousand tons annually. We conclude that considering remanufacturing this type of paper as a raw material in the production of the intended established factory will cover 91% of the factory's daily needs, as the capacity of the project to be established is about 65 tons/day, and the average quantity of paper produced and imported is about 59 tons/day, with a 50% damage rate. In summary, the total quantities of paper produced and imported in Iraq was 3.2 million

tons for the period 2010-2021, the table 9 shows with an average of about 270 thousand tons. The imported quantities recorded a growth rate of 23% due to the increase in local demand. The year 2021 recorded the highest import rate of 250 thousand tons with a total value of about 227 million dollars. During the same year, 85 thousand tons were exported. The total value of the imported paper during the period 2010-2021 was about 1.5 billion dinars, with an average of about 131 million dollars annually and an average price of about 986 dollars per ton, while the total value of the exported quantities during the same period was 134 million dollars, with an average of about 11 million annually and an average price of about 134 dollars per ton. The total quantities of paper available for recycling annually are 273 tons annually, or about 750 tons / day. Assuming that paper recycling rate is only about 25% and the loss rate is about 75%, so the size and quantity of raw materials used in the factory will constitute and cover 29% of the recycled paper market size. The factory will also contribute to achieving savings in cash of the US dollar by first reducing imports of Kraft paper and second by raising the added value of exports of the final product, as Kraft paper production line will increase the added value to about $800 per ton, i.e. an increase estimated at about $640-700 per ton, while the production of the corrugated (unorganized) paper line will raise the added value to about $1200, i.e. an increase of about $1100. This will raise the value of exports to about $14 million annually. In light of the results of the marketing feasibility study, we conclude that the paper recycling plant project to be established with a capacity of 65 tons per day is economically feasible and that there are sufficient quantities of raw materials to ensure the plant operates at 100% of its production capacity and that the size of the local market is capable of absorbing the annual production quantities with the possibility of exporting the project's products to global markets.

Table 8. Quantities of paper for other uses produced, imported and exported in Iraq for the period (2010-2021)

Year	Production Ton	Import Quantity Ton	Import Value 1000 US$	Export Quantity Ton	Export Value 1000 US$
2010	**11000**	**3624**	**5288**	**106**	**99**
2011	**11000**	**3166**	**5618**	**106**	**99**
2012	**11000**	**8565**	**9140**	**106**	**99**
2013	**11000**	**20370**	**18039**	**106**	**99**
2014	**11000**	**27716**	**27029**	**106**	**99**
2015	**11000**	**31500**	**28130**	**210**	**192**
2016	**11000**	**46826**	**44854**	**114**	**110**
2017	**11000**	**41881**	**43471**	**114**	**110**
2018	**11000**	**44709**	**54339**	**16**	**28**
2019	**11000**	**52640**	**50980**	**59**	**56**
2020	**11000**	**52559**	**55030**	**8**	**10**
2021	**11000**	**52559**	**55030**	**8**	**10**
Total	**132000**	**386115**	**396948**	**1059**	**1011**
Means	**11000**	**32176.25**	**33079**	**88.25**	**84.25**

Source: Food and Agriculture Organization of the United Nations (FAO) statistics.

Table 9 Total quantities of paper produced, imported and exported in Iraq for the period (2010-2021)

Year	Production Ton	Import Quantity Ton	Import Value 1000 US$	Export Quantity Ton	Export Value 1000 US$
2010	38000	20434	25434	547	378
2011	38000	26848	34599	2402	725
2012	49000	39509	41515	17739	3169
2013	61000	65316	61981	28800	4177
2014	58000	94033	96713	26544	4400
2015	97000	112453	107104	65448	9457
2016	172000	169369	161269	138351	19897
2017	237000	170127	175980	201937	33104
2018	222000	196379	219682	185041	23312
2019	237000	239300	226923	120321	14143
2020	237000	211448	200680	85846	11060
2021	237000	254856	227302	85846	11060
Total	1683000	1600072	1579182	958822	134882
Means	140250	133339.3	131598.5	79901.83	11240.17

Source: Food and Agriculture Organization of the United Nations (FAO) statistics

RESULTS AND DISCUSSION

Financial feasibility study:

First: Estimating expected revenues: The factory produces two products, firstly, soft brown wrapping paper, which is produced in varying degrees of softness according to the type of local and global demand for the factory's products. Part of the brown paper production is also converted into corrugated paper industry. It was assumed that the production rate would be 50% of each product and that the factory's operating rate would be about 80% of the design capacity. Assuming that the number of working days is 300 days/year, with one shift per day for (8) hours per shift, the daily production quantity of brown wrapping paper would be 26 tons/day, and the daily production quantity of brown wrapping paper after the corrugation process would be 26 tons/day. The selling price of brown wrapping paper was estimated at 870,000 Dinars per ton, which is the lowest common price. The selling price of brown wrapping paper after the laminating process was estimated at 1305000 Dinars per ton, which is the lowest prevailing price rate. The Table (10) shows the expected annual production quantities, their prices, and the total revenue of the project, as follow :

Second: Estimating the expected costs : Investment costs :

1- Land cost: The project is built on a land area of 5 dunams, or about 12.5 thousand square meters, and the project owner owns a land area of 5 dunams located in an industrial area close to power lines and public transportation lines, with a value of about (250,000,000) dinars, where 300 square meters will be allocated for the administration building, and about 7200 square meters will be allocated to build three steel structures to accommodate the production lines, and about 2000 square meters will be allocated to build warehouses, and the following table shows the division of the land in the project, as shown in Table (11).:

Table 10. Expected project revenues

Item	Quantity ton	Price per ton Dinar	Total revenue dinar
Smooth Brown Wrapping Paper	7800	870,000	6,786,000,000
Brown Zigzag Paper	7800	1,305,000	10,179,000,000
Total	15600		16,965,000,000

Source: Prepared by the researcher based on the capacity of the production lines

Table 11. Buildings Civil and engineering works required for the project

Statement	Total area m^2
Administration Building	300
Main Factory Building	7200
Main Warehouse Gable	2000
Sedimentation Tanks	600
External Gate and Inquiries	50
Maintenance Workshop	600
Roofs	600
Internal Sidewalks and Streets	345
Total	11695

Source: Prepared by the researcher considering the technical study of the project and according to the plans specified by the company supplying the production lines.

2-Cost of buildings and engineering works: The project requires the construction of three steel structures for industrial use with dimensions (120 x 20 m) and a height of 10 m. The walls will be made of block material and roofed with fire-resistant sandwich panel material and supported by steel columns. Two structures will be built with dimensions of 50 x 20 m, which will be used as warehouses for raw materials. The administrative building will also be built with an area of 300 square meters of bricks and the roof will be made of reinforced concrete. The building will have two floors to cover the project's needs for administrative offices and a meeting hall. The first floor will be allocated to the accounting department and other administrative departments, while the ground floor will be allocated to the marketing and production department and the administration offices. The total cost of civil engineering works in the project is approximately (4,023,350,000) dinars according to the standard document of the Iraqi Industrial Bank, which lists the costs of buildings and engineering works.

3- Cost of machines, equipment and tools: The project consists of the main production and manufacturing line of paper waste, which will be equipped according to the offer submitted by the Indian company Herbal and attached to the study, at a value of 1.5 million dollars, or about 2.1 billion Iraqi dinars, and the brown wrapping paper laminating line, which is worth about one million dollars, or about 1.4 billion dinars, so that the total cost of the production lines will be about 3.5 billion dinars. The project also requires machines, equipment and various means of transportation. The total cost was estimated considering the common prices for the production lines according to the offers of the equipped companies at about (5,364,300,000) dinars.

Operational costs in the project :

They are divided into the following:

•Costs of commodity requirements: These are the costs of purchasing raw materials from waste paper and industrial materials and water and electricity fees, which are directly linked to the quantities produced from recycled paper. The cost of materials and commodity requirements considering the project's needs and market prices was about (3,715,596,800) dinars.

•Costs of service requirements: These include all fixed costs spent on basic services in the project, including administrative costs, insurance, spare parts, and the emergency budget, in addition to social security. The costs of service requirements are (697,709,600) dinars.

•Annual salaries and wages: The project also needs various skills in managing and operating the project to cover its activity, as the project provides about 80 direct job opportunities, and it also provides indirect job opportunities. The average annual salaries and wages in the project are (805,200,000) dinars, and local labor will be relied upon by 95%.

•Borrowed capital costs: As for financing the project, 76% of the project will be financed by a long-term loan of 10 billion dinars from a bank for 15 years at an interest rate of 2%. The annual borrowing costs is approximately (200,000,000) dinars.

•Annual depreciation installment: The annual depreciation costs were estimated using the fixed percentage method according to the laws of the Iraqi Governorate. The annual depreciation installment is approximately (737,597,500) dinars, as shown in Table (12).

Table 12. Table of operating cost items in the project

Item	Dinar
Production requirements	3,715,596,800
Service requirements	697,709,600
Salaries and wages	805,200,000
Annual depreciation	737,597,500
Interest on borrowed capital	200,000,000
Total	6,156,103,900

Source: Prepared by the researcher based on the technical and financial study data for the project

Table 13. Total cost items table for the project

Item	Cost / Dinar
Land	250,000,000
Buildings and facilities	4,023,350,000
Machinery and equipment	5,364,300,000
Establishment expenses	350,000,000
Test operating expenses	379,295,448
Fixed capital	10,366,945,448
Working capital	2,709,253,200
Total capital	13,076,198,648

Source: Prepared by the researcher based on the technical and financial study data for the project

Third: Criteria used in evaluation

The level of the performance appraisal system reflects the maturity of society in facilitating its affairs and represents the tool by which we recognize the current reality in preparation for its development (20). Assessing projects is increasingly important as the country tends to reduce the role of the public sector and the role of the private sector and to optimize the use of available resources by channeling these resources to the best available uses or so-called rational use (7). Economic efficiency is defined as the use of sources of wealth in such a way as to achieve one of two things: first, achieving greater production at the same past production costs; and second, the same production at lower costs of production (14). It also defines the maximization of profit within the production unit using the ideal elements of production (12). The process of studying the efficiency of performance in the economic project is closely related to the evaluation process and the feasibility of the project, because the objectives of the project, which are expected to be achieved in the short and long term through economic activities have been developed and determined based on the criteria and bases adopted in the evaluation of projects (1). All this makes the process of studying and evaluating farms comprehensive and integrated in nature, and therefore, determining the appropriate criteria for agricultural activities is one of the most important bases in the process of assessing the efficiency of agricultural activity in those projects. The evaluation process takes place in all economic activities, whether agricultural, industrial or service activities. There is no fundamental difference in the evaluation of these activities, but the difference in how to choose the appropriate criteria for each activity (9). The research has adopted a set of evaluation criteria.

Pay-Back period (PBP): The period required to recover the capital invested in the project (2) the length of time in which the revenue can pay the amounts invested in the farm and uses the law below to calculate (14).

$$\mathbf{PBP} = \frac{\text{Capital invested}}{\text{Annual profit}}$$

Simple Rate of Return (SRR): This criterion is sometimes called the accounting rate of return since it depends on predicting what the results of the profit and loss accounts in the accounting entries will be and calculated using the formula:(9)

$$\mathbf{SRR} = \frac{\mathbf{Annual\ profit}}{\mathbf{Capital\ invested}} \times \mathbf{100}$$

Benefit-Cost Ratio (discounted profitability index): It is dividing the present value of cash inflows of the project on the present value of cash outflows from the project (19). It is desirable to follow one way in the calculation of this indicator when we use the basis for the evaluation of projects in the country to minimize the misleading projects in the order

of selection opportunities. To choose between alternatives, priority is given to those projects that achieve the highest rate in the economic evaluation process, and this standard can be expressed mathematically a follows (9):=

$$\frac{\mathbf{B}}{\mathbf{C}}\mathbf{ratio} = \frac{\sum_{t=1}^{n} \frac{B_n}{(1+r)^n}}{\sum_{t=1}^{n} \frac{C_n}{(1+r)^n}}$$

As: B/C Ratio: benefit/cost Ratio, B_n: inflows. C_n: outflows .N: Age of Economic Project. R: interest rate.

This equation represents the first criterion for evaluating the economic feasibility table and the general rule is to accept projects that when the benefits are divided by the present value of the costs by the present value, the result is one and more true in the case of one project, either in the case of several projects, the project that achieves the highest rate is the most feasible economic aspect (9).

Net present value N.P.V: present value is defined as a means of calculating the present value of cash inflows and outflows of an investment. The net present value considers the time value of money (14). This concept overcomes the difficulty of trying to reconcile the costs and returns that arise during different periods of time by making all amounts equal, converting them to a common basis or a present common value so that all financial costs are equal to future financial returns (18) by using a discount factor to discount cash inflows to their present value, after which the present value of all cash inflows is compared with outflows (24). This is expressed mathematically as follows (9):

$$\mathbf{NPV} = \sum_{t=1}^{n} \frac{B_n}{(1+r)^n} - \sum_{t=1}^{n} \frac{C_n}{(1+r)^n}$$

As: NPV: Net Present Value. B_n: inflows. C_n: outflows. N: Age of Economic Project. R: interest rate.

Cash flow and discount rate are key factors in the NPV calculation (9). Whereas the NPV standard includes an assessment of the present value of cash flows represented by the expected profit dividend using a discount rate that considers the investment risk, the value obtained is compared to the initial cost (9). In general, the investment project is accepted if it is NPV > 0, and rejected if it is NPV < 0. The investment project covers its economic costs only if (NPV= 0). One disadvantage of using this is that if the funds invested differ from one project to another, the comparison does not produce results with meaningful meaning (22). Therefore, in order to overcome the weaknesses of this standard has been made some amendments to it, instead of dealing with the total return achieved, was adopted and dealt with the monetary unit invested revenue, which is the common denominator of capital invested in various projects.

Internal Rate of Return: Internal Rate of Return (IRR) is the projected rate of return on an investment and is therefore defined as a discount rate that is equal to the present value of the expected cash flows with the investment expenses (24). Thus, the IRR is only a discount rate that makes the net present value equal to zero (9): The NPV and IRR criteria generally lead to the same decision of acceptance or rejection with respect to investment choice (23). However, there are instances where the application of these criteria leads to conflicting results. The reasons for this discrepancy are the different assumptions of the NPV and IRR regarding the rate at which the cash flows are reinvested, as the two methods assume that such funds invest at a different rate of return (9). Net present value implies that the rate at which cash flows can be reinvested is the rate of return required, while the internal rate of return indicates that the investor has an opportunity to invest at the same internal rate of return(26). The internal rate of return is defined as the discount rate that makes the NPV reach zero. It is also known as a discount rate that equals the present value of cash flows over the life of an investment with the value of the initial investment. The IRR value of an investment can be calculated (assuming that the initial investment value is achieved in year 0 by equating NPV with zero as follows (9):

$$\mathbf{IR}\mathrm{R} = \sum_{t=1}^{n} \frac{B_n}{(1+r)^n} - \sum_{t=1}^{n} \frac{C_n}{(1+r)^n} = \mathbf{0}$$

As: NPV: Net Present Value. Bn: inflows. Cn: outflows. N: Age of Economic Project. R*: Internal Rate of Return.

The value of R* must be found that meets the following condition (NPV = 0), as R * will represent the IRR of the proposed investment.

This rate will represent the profitability of the capital invested in the project throughout its useful life, that is, during the period in which it resides (26).

Table 14. Results of undiscounted and discounted commercial profitability criteria

Criterion	Value
Profit	**10,808,896,100**
Accounting Rate of Return	**82%**
Return on Invested Dinar	**2.756**
Debt Ratio	**76%**
Break-even Point	**1729**
B. E. P. Production Capacity Ratio	**%11**
Production Safety Margin	**%89**
Net Present Value	**78,403,069,418**
Internal Rate Return	**%115**
Benefits/Costs Ratio	**2.547**
Pay Back Period	**2.13**

Source: Prepared by the researcher based on the project's financial data

The Table (14) shows expected to achieve an annual profit of 10,808,896,100 Iraqi dinars, which is, and that the project will recover all the money invested in it within a year and a half. The Pay Back Period criterion reached about 1.13. The value of the accounting rate of return ARR is 82%. It was found that the value of the net present value criterion amounted to 78,403,069,418 Iraqi dinars. The discounted profitability index criterion B/C amounted to about 2.546. It was also found that the internal rate of return criteria was (115%). meaning that the project will achieve a return on investment greater than the cost of alternative opportunities, which shows the feasibility of investing in this project. The project will provide about 80 new job opportunities directly in addition to the indirect job opportunities that it will provide, which will contribute to absorbing part of the unemployed workforce. The isk analysis proved that the project can withstand a 60% decrease in revenues, while the break-even point amounted to about 1729 ton. The sensitivity analysis proved that the project is not sensitive to changes in investment costs, as it proved that considering the initial investment increase of 780%, the project will continue to achieve economic feasibility. The sensitivity analysis proved that the project is not sensitive to changes in operating costs, as considering the increase in operating costs of 190%, the project will continue to achieve economic feasibility, due to the decrease in operating costs. The sensitivity analysis proved that the project is not sensitive to fluctuations in the prices of the project's products. Sensitivity analysis has shown that under various conditions the project is able to repay the loan within a maximum period of seven and a half years. Based on the above results, the project is economically feasible according to the results of the financial criteria and indicators.

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