



USAID
FROM THE AMERICAN PEOPLE

IDENTIFICATION OF R&D OPPORTUNITIES FOR THE PACKING AND LIGHT INDUSTRIES SECTORS

Final Report

May 30, 2008

This publication was produced for review by the United States Agency for International Development. It was prepared by Dr. Fawwaz El Karmi and Eng. Mohammad Sartawi / Bearing Point Inc.

IDENTIFICATION OF R&D OPPORTUNITIES FOR THE PACKING AND LIGHT INDUSTRIES SECTORS

USAID JORDAN ECONOMIC DEVELOPMENT PROGRAM (SABEQ)

CONTRACT NUMBER: 278-C-00-06-00332-00

BEARINGPOINT, INC.

USAID/JORDAN

OFFICE OF ECONOMIC GROWTH

MAY 30, 2008

AUTHOR: DR. FAWWAZ EL KARMI AND ENG. MOHAMMAD

SARTAWI / BEARING POINT INC.

DELIVERABLE N^o: 4.5.4.26.3.3

DISCLAIMER:

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

CONTENTS

1. INTRODUCTION.....	2
2. BACKGROUND INFORMATION.....	5
2.1 Previous work	5
2.2 R&D Indicators	6
3. OBJECTIVE OF WORK	8
4. METHODOLOGY.....	8
4.1 Process Tools	8
4.2 Sample Selection	9
4.3 Pilot Test	10
4.4 Data Collection	10
5. ANALYSIS OF RESULTS	11
5.1 R&D Demand Side	11
5.2 R&D Supply Side	16
5.3 Supply and Demand Match	22
6. CONCLUSIONS	23
7. REFERENCES	24
8. ANNEXES.....	25
8.1 Questionnaires (Demand Side)	
8.2 Questionnaires (Supply Side)	
8.3 List of Industries Involved	
8.4 List of Universities and R&D Centers Involved	

DISCLAIMER:

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

INTRODUCTION

No one denies that research and development (R&D) activities are very beneficial to the national economy of any country at both the micro as well as at the macro level. Any productive enterprise; being industrial, service or business oriented, will definitely need R&D activities to improve quality, enhance productivity, reduce cost, introduce new products, conserve resources, or any combination thereof. These activities will guarantee that the enterprise involved in R&D will prosper, grow, and sustain its market position and increase profits. Naturally someone may argue that he/she does not need R&D. This simply means that he/she is "committing suicide" in business terminology, or more nicely put will eventually go out of business.

At the macro level R&D activities create backward and forward linkages among the productive enterprises and R&D centers. Moreover, new businesses may spin-off, spin-out, or spin-in as a result of such activities. This will also create job opportunities, contracted services, and support the other non-profit activities of the centers. Therefore, R&D as such is an engine of economic development needed by any economy developed or developing. The difference is that for developed economies there is a steady momentum of R&D activities and their benefits, while for developing economies the process is intermittent and not structured.

In developed economies researchers possess very high status among their non research peers, while in developing economies the story is quite different. Incentives for researchers are almost non-existent in developing economies, and at the same time there are no research posts or complete time and effort devotion to R&D activities. Therefore scientific research is considered a requirement for teaching at higher education enterprises, or as a cash generation service for other centers in developing economies.

Knowledge creation and innovation are not targeted by developing economies, although they are highly sought by developed economies. This is because R&D activities need an environment to be effective. This environment has prerequisites and success factors. The prerequisites and success factors are interrelated, interchangeable, and interdependent. These include: clear and transparent policies and strategies, human resources, physical facilities, and funds. In certain aspects the prerequisites, or minimum requirements, may become success factors and vice versa. It is true that success factors need certain prerequisites in order to be effective, but the converse is not necessarily true. However, in certain special cases success stories are achieved even in the absence of certain prerequisites. For instance, innovation is achieved with very little funds, facilities, and even policies and strategies. The only prerequisite that could make a difference in this case is human resources and another important factor which is willingness to succeed. This is quite similar to growing a plant in a medium other than soil and without the traditional nutrients.

Developing countries must therefore, seek a two path strategy; a regular, structured, long term path and an innovation-like environment path. This way the long term path, if properly designed, will lead to a sustained, but slow success, while the innovation path will lead to success stories, which will help focus and concentrate the efforts in the long term path. In order to identify success stories, create an environment of self confidence, and set an example to be followed, there is a need to conduct an assessment of both sides of R&D; namely supply and demand. R&D supply is represented by higher education institutions and research centers, while demand is represented by productive enterprises contributing to GDP. A candid and sincere

evaluation of R&D prerequisites and success factors will be a first step towards formulating the needed innovation environment short term path.

This report is a result of a collaborative effort of a team of local consultants and the USAID-funded Sustainable Achievement of Business Expansion and Quality (SABEQ) program. SABEQ program is a broad-based economic development initiative implemented by Bearing Point, Inc. of the U.S.A. and an experienced team of international and Jordanian partner firms. By both supporting improvements in the business environment and providing assistance to expand innovation and productivity in Jordanian businesses, SABEQ's components all support the common objective of building up the private sector—Jordan's companies, innovators and entrepreneurs—as the most powerful engine of economic growth. One of those key SABEQ components is the Enhanced Productivity Component. This component connects directly with private sector with the following objectives:

- Enhanced competitive and innovative priority sectors through improved product and service offerings stemming from a more skilled workforce, and the application of globally-recognized best practices including sustainable technology.
- Increased market access and demand for priority sector products and services.
- Expanded capacity of targeted associations to serve as partners in sustainable economic transformation of the priority sectors.

The report thus is based on a survey of only two industrial sectors, as a model, which might be extended to other productive and economic sectors. These sectors are; **packaging** and **light Industries** sectors. The main aim of the survey is to attempt to identify R&D opportunities which might be translated to R&D contracts between these two sectors and the R&D centers possessing the capabilities and competencies to conduct the required research.

We show below some indicators of the Packaging and Light Industries sectors:

Packaging Sector:

The Jordanian packaging industries based on type of materials used include paper, carton, plastics (PP, PET, PVC, PS), Glass, metal and wood. Packing and packaging sector comprised 2.5% of total industries in Jordan and 2.7% of the labor force are employed by the sector. Packing and packaging industries classified under ISIC: 2101 developed as follow: [1].

- Production: Increased from 21 million JD in 1996 to 41 million JD in 2003.
- Exports comprised 9% of total sector sales in 2003 [2].

Plastic sub - sector.

Plastic industry and products in Jordan is linked to several industrial sectors including pharmaceuticals, cosmetics, home appliances, electrical & electronic products, food industry, and packing industry.

Jordanian plastic industries utilizes several developed technologies including Blow molding and extrusion. Plastic sub sector employees counted 5,662 in 2005 Gross output of plastic sub - sector reached (205) million JD in 2005 compared to 90 million JD in 2000. Export of plastic sector increased from (31.4) million JD in 2000 to (38.4) million JD in 2005 including export to more sophisticated markets such as the US market. [3].

Furniture sub - sector

Furniture production facilities are concentrated in Greater Amman Area . There exit three distinguished types of furniture plants which are:

- 1 -Industrialized production facilities that produce standardized furniture pieces including office furniture, bedroom sets and other home furniture. .An example of such plants is the production facilities owned and operated by the Jordan Wood Industries Co (JWICO).
- 2 - Small scale furniture facilities consisting of furniture production hall, painting ovens, upholstery section and product finishing. Some of the small scale furniture plants sub - contract part of their production parts and this may lead to higher quality and better control of costs.
- 3- Carpentry shops which are not classified as industrial plants yet are capable of producing in full certain wooden furniture pieces such as tables, chairs wall units ...etc . In addition, those shops produce according to orders for direct clients or they are subcontracted by larger furniture producers.

The weight of furniture industry relative to the industrial sector was 2.024 in 1999. [4].

The production index for the period (Jan - Oct 2004) was 110.4 (an increase of 15% over 2003 [5], According to the furniture industry survey for 2003 [1].

- No of establishments = 1660
- Total registered capital : 21.7 million JD

TOTAL WORKERS : 6110 BACKGROUND INFORMATION

PREVIOUS WORK

In Jordan several efforts and attempts have been devoted to formulating and developing R&D policies and strategies. In all sincerity, there has been some appreciable success in this domain. However, this was either not enough or has not been matched with achievements in other prerequisites and success factors to reach an acceptable level of sustainability and economic development on the micro or macro level. Therefore, the result was that there were some sporadic successes and innovations, but they can not be claimed or tied to the R&D policies and strategies. They are simply the result of the initiative, perseverance, and willingness to succeed of those individuals and enterprises involved.

An assessment of the status of R&D in Jordan will reveal several shortcomings and constraints which must be addressed and rectified in order to improve the situation.

A review of previous studies, which have assessed R&D in Jordan, points out to certain key issues, which are surprisingly the same in all studies. The first study entitled: "Critical Review of R&D in Jordan"[5] revealed that although Jordan is endowed with twenty public and private universities (at the time), R&D activities are performed at some of the public universities only. Moreover, most of the research conducted is primarily basic or fundamental research carried out for the purposes of promotion. Another fact pointed out by the study is that the R&D centers outside the higher education institutions concentrate on S&T services rather than R&D activities because of limitations or non availability of funds. On the other hand the industrial sector's appreciation for R&D in general and local R&D competencies in particular is limited, to say the least. Therefore, the willingness to invest in R&D activities does not exist.

Another study entitled: "Innovation Policy for Jordan"[6] was an attempt to formulate an innovation policy in Jordan or at least to identify key issues in such a policy. The study reveals that university professors are not eager or willing to participate in R&D programs if they do not personally benefit from such programs. Furthermore, they are really burdened with teaching activities to the extent of having several hours of overtime. This could be easily rectified if research posts were available in public universities, or if sabbatical leave regulations insisted on working on R&D rather than only teaching. The study also pointed out that R&D in Jordan is supply-driven rather than demand-driven, because industries and businesses are skeptical about local capabilities in R&D and due to limitation in funding for R&D activities.

A third study entitled: "Research & Development Strategy for Information and Communication Technology 2007-2010"[7] points out that in order for Jordan to seize the opportunity to take place in the vanguard of the global knowledge economy and information society it needs to focus on certain success factors, which constitute the overall framework for the implementation strategy. These factors include:

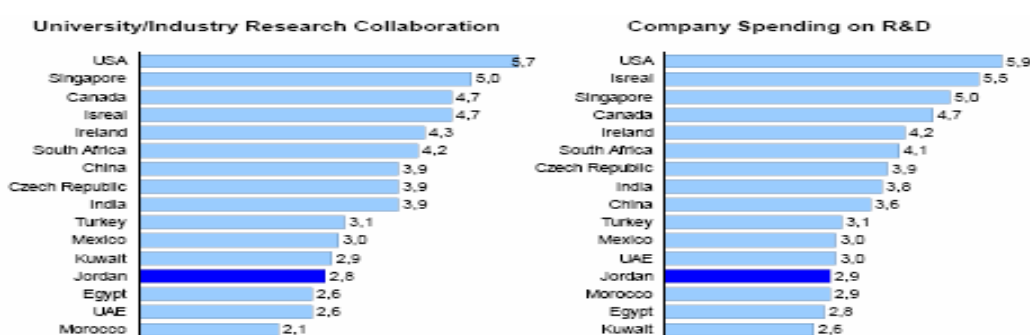
- Commitment by the three stakeholders (government, academia, and private sector) to dedicate resources (personnel and financial) in order to embrace the partnership model to implement the strategy.
- Promotion of incremental R&D as well as disruptive R&D.
- Market-driven approach, whereby the private sector takes the lead in identifying R&D opportunities that can be commercialized.
- Government should selectively intervene to complement market forces where the private sector and academia cannot.

R&D INDICATORS

The status of R&D in Jordan can best be illustrated by presenting some indicators, which are borrowed from [7] as follows;

"Jordan's situation in terms of research, development and innovation is mixed. Authorities are making large efforts in the domain of education, with good results in terms of instruction and a rather remarkable rate of university access in certain disciplines (science, mathematics and technology). The country possesses 10 public and 14 private universities which constitute an essential element of the basic R&D infrastructure. In addition, Jordan has a higher proportion of university graduates in technological fields than any other country in the region. Jordan ranked 14th out of 110 countries for the number of engineers and scientists according to the Global Competitiveness Report 2004-2005 (WEF)".

Figure 2.1: Universities/Research Collaboration, Company spending on R&D in selected countries



Source: Global Competitiveness Index

Figure 2.2: Research in R&D (per million people), availability of scientists and engineers in selected countries

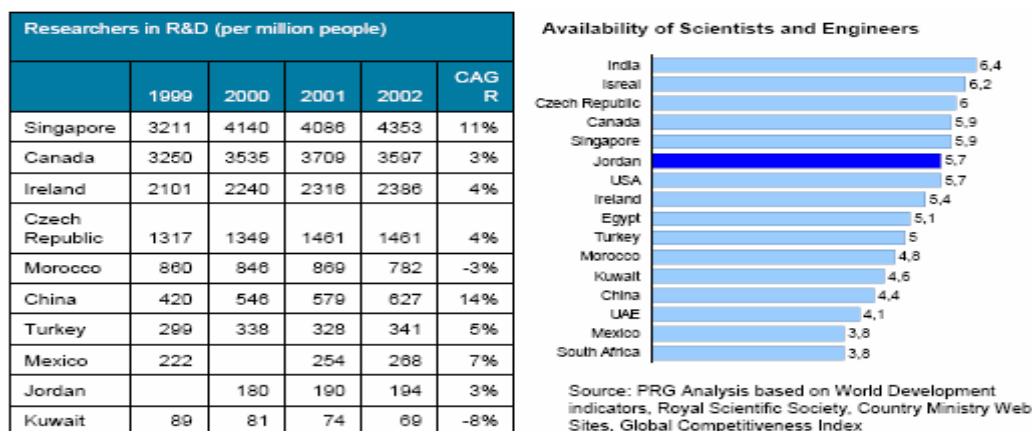


Figure 2.3: Quality of scientific research institutions in selected countries



Source: Global Competitiveness Index

Table 2.1: Number of patents registered in USA for the period (1976-2002)

Country	No. of patents
Yemen	3
Lebanon	4
Syria	16
Jordan	22
Tunis	23
Morocco	65
Kuwait	75
Egypt	104
Saudi Arabia	225
Israel	11,071
Sweden	26,318
South Korea	27,298

Source: US Patent & Trade Mark Office

OBJECTIVE OF WORK

1. Identification and opportunities determination of R&D requirements in the Packaging and Light Industries sectors and sub-sectors in Jordan. In other words, analysis of demand for R&D activities in the targeted sectors.
2. Study and analysis of R&D supply provided by national R&D competencies according to type of institution and research area of interest.

METHODOLOGY

PROCESS TOOLS

I. Design of process tools for Data Collection

Process tools for data collection in the targeted industrial sectors and Research and Development institutions involved the following:-

1. Identification, classification and analysis of industries in each sector:-

- Search and listing of all industries under **Packaging and Light Industries** sectors in Jordan using several data bases including Department of Statistics (DOS), Jordan Enterprise Development Co. (JEDCO), Amman Chamber of Industry and other chamber of Industries,. A detailed list of Industries with basic information was developed (addressees, products, location, size ... etc.)
- Study and analysis of industrial classification systems including International System for Industrial Classification (ISIC), JEDCO system, DOS system and Amman Chamber of Industries system. JEDCO system was adopted for sector / sub-sector based on

agreement with SABEQ. Listing of all industries was made according to the following sector / sub-sector classification:-

Table 4.1: Number of Industries in the targeted sectors

Sector / Sub - sector	No. Of Industries
i. Packaging Sector (Including all types of packaging materials but does not include packing)	80
ii. Light Industries Sector	
● Furniture sub-sector	
— Home & kitchen	42
— Office Hospital & labs	
— Carpets and rugs	36
● Plastics sub-sector	20
● Steel Metal Fabrication sub-sector	110
Total light Industries Sector (sub total)	60
	268
iii. Total Industries in Targeted Sectors	348

2. Identification and analysis of R & D Institutions

As agreed with SABEQ and according to the Terms of Reference (TOR) of this work, R&D institutions include all public universities and research centers (list is attached in Annex 8.3)

3. Design of Questionnaires

Two separate questionnaires were designed as tools for data collection through direct interviews and telephone contacts.

- Questionnaires to survey R&D in targeted industrial sectors / sub-sectors (i.e. the demand side) containing 21 questions aiming at identification of R&D opportunities (copy of this questionnaires is attached in Annex (8.1). Questionnaire was designed in draft form and agreed upon with SABEQ.
- Designed questionnaire to survey R&D activities in public universities and research centers to identify, study and analyze research policies, research staff, R&D facilities, activities and funding. In addition, the questionnaire includes questions related to R&D indicators (publications, books published, patents, etc.). (copy of this questionnaire is attached in Annex 8.2).

SAMPLE SELECTION

The researchers adopted the sample approach to survey targeted industries for R & D opportunities. Selection of representative sample was based on 10% of the total population (i.e. industries within the packaging and Light industries Sectors) and based on the following criteria:-

1. **Sectors and sub-sectors:**

27 companies Representing light industries

8 companies Representing packaging

Representing 10% of the total industries

Total 35 companies

2. **Type of products:**

The 8 packaging industries represent almost most types of packaging materials. Furthermore, light industries cover home furniture, kitchen furniture, and office; laboratory; and hospital furniture. In addition, the sample includes steel metal fabrication (steel buildings, and several steel fabrication plants). Plastic companies include various end / consumer products, intermediate products and rubbers.

3. **Size of industries**

The selected sample covers small, medium and large plants measured in terms of capital investment, production size and manpower.

4. **Geographical Location**

Industries in Greater Amman Area, Irbid and Zarka were covered.

PILOT TEST

Pilot phase was considered for the targeted industrial sectors. However, no pilot phase was considered for R&D institutions. The rationale and justifications for the pilot phase for the targeted industrial sectors in explained as follows:-

1. Population of targeted sectors is relatively large (348 industries and sample size of 35 industries).
2. Lack of awareness of R&D importance hence weak response is expected.
3. Limitation of past similar documented research; thus lack of experience and uncertainties of responses of interviewees.
4. Accordingly, five companies were selected for pilot phase and data were obtained through direct interviews. (Companies include one packaging plant, one steel fabrication firm, one plastic plant, and two furniture companies). Based on the results of the pilot phase, questionnaire was amended and modified and an official letter was obtained from SABEQ to facilitate the research and data collection. The five pilot-phase companies were considered within the sample selected for the surveys and results were integrated and utilized for demand analysis.

DATA COLLECTION

Data were collected for targeted industrial sectors / sub-sectors and public universities and research centers, through direct interviews of concerned personnel. In addition, questionnaires were faxed and e-mailed, upon the request of most interviewees, and follow-ups through telephone calls were made to answer their questions and complete data collection. Answers of respondents were fully documented.

ANALYSIS OF RESULTS

R&D DEMAND SIDE

Field visits to the selected sample of industries were undertaken in order to analyze the current R&D demand and requirements. A questionnaire was designed for the purpose of the field visits and structured interviews were conducted. Field visits to the main segments of the Packaging Sector and Light Manufacturing sector including, furniture, plastics, and steel fabrication companies were conducted.

A representing sample of both the packaging sector and light manufacturing sector was taken in order to formulate a better understanding of the current requirements, demand, and R&D status in the packaging and light manufacturing sectors in Jordan. Although, some companies refused to cooperate in the demand survey especially from furniture companies, the data collected and presented in this report achieved the purpose of identifying R&D needs, status and challenges facing R&D in both the Packaging and Light Manufacturing Sectors in Jordan.

Table 5.1 below illustrates the number of filled questionnaires in the targeted sectors.

Table 5.1: Number of filled questionnaires in the targeted sectors

Sector/Sub Sector	No. of filled questionnaires
Packaging	7
Light Manufacturing	
Furniture	9
Plastic	11
Steel Fabrication	8
Total	35

The furniture sub sector was categorized into 5 main areas, these are: Home furniture, hospital and lab furniture, carpets, rugs & mattresses, house ware products, in addition to office furniture.

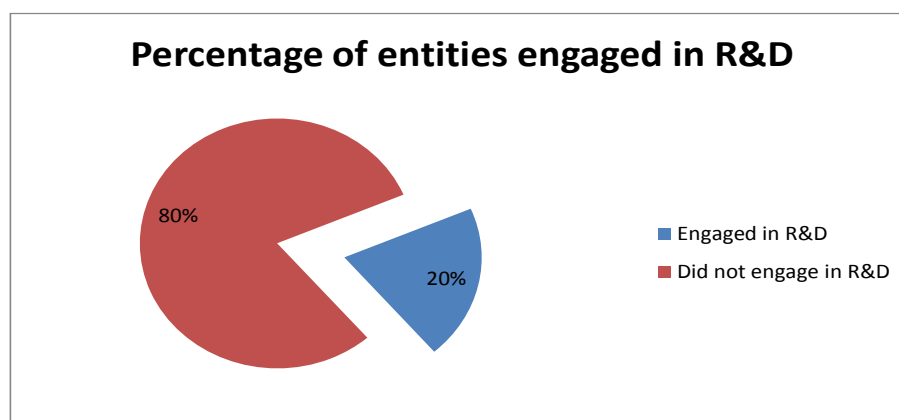
The demand side questionnaires addressed five areas of interest, these are:

- R&D Status
- R&D Activities
- Requirements
- Utilization of funds/resources
- Opportunities

The following sections illustrate the results and analysis of the data collected based on the field visits, and interviews conducted with the targeted entities:

Chart 5.1 below presents the percentage of entities engaged in R&D activities during the last three years.

Chart 5.1: Percentages of entities engaged in R&D activities in the period (2005-2008)



From chart 5.1 above, it is to be noted that 80% of the interviewed entities did not engage in R&D activities during the last three years, which is considered weak when compared to regional indicators as mentioned earlier. On the other side, only 37% of the interviewed entities said that they manufacture at least some of their products on the basis of acquired knowledge, while the other 63% identified that the products being manufactured are considered traditional and similar to other available products in the market with no value added.

Table 5.2 below illustrates the percentages of entities engaged / did not engage in R&D activities according to the classification mentioned in table 5.1 above.

Table 5.2: Percentage of entities engaged in R&D activities classified according to its sub sectors

Classification	Yes (%)	No (%)
Plastic	16	82
Furniture	22	78
Packaging	14	86
Steel Fabrication	25	75

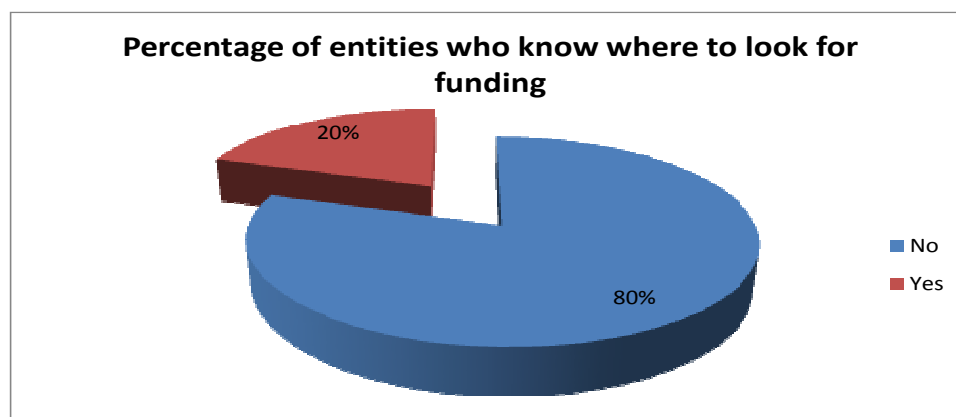
As for the main reasons for not commencing in R&D activities, the interviewed entities identified the following;

- 43% of the interviewed entities said that the main reason for not conducting R&D is due to the insufficiency of funds
- 22% identified that the main reason for not initiating an R&D activity is due to the lack of resources and lack of skills and capabilities
- 32% of the interviewed entities said that currently there is no need to conduct any R&D as the product being produced is considered traditional and the market is demanding such a product. This view was mainly presented by some of the steel fabrication and plastics companies.
- The remaining 1% identified that they do not know about R&D activities and their benefits.

On the other side, 43% of the interviewed entities said that the currently used machines/tools are hindering the possibility to initiate an R&D activity, while the other 46% of the interviewed entities said that this is not considered the main issue as other factors such as skills/capabilities and available resources are needed.

Chart 5.2 below presents the percentages of the interviewed entities who know where to look for funding.

Chart 5.2: Percentages of entities engaged in R&D activities in the period (2005-2008)

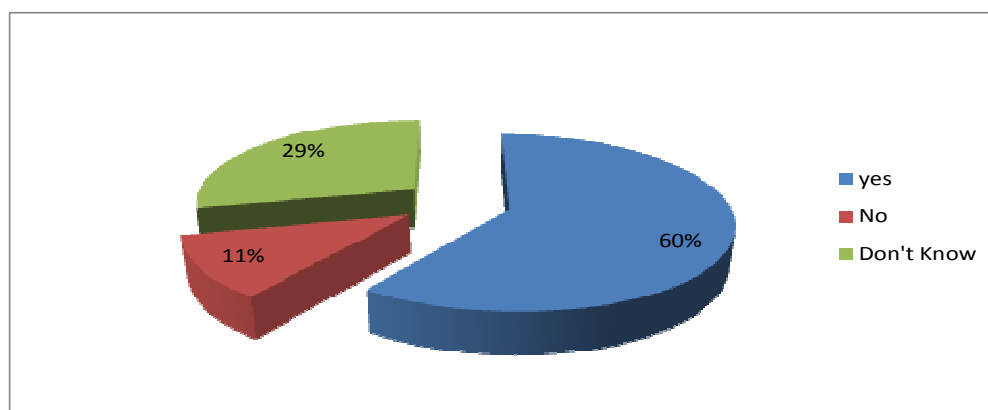


It is worth mentioning here that 94% of the entities participated in the survey, showed interest in hearing about R&D opportunities in the coming period. Additionally, the participated entities identified the following comments and changes that might reflect on their organizations when considering R&D project/activity:

- Increase productivity
- Improve quality of products
- Customers satisfaction
- Improve competitiveness
- Reduce cost
- Better utilization of human resources
- Open new markets

Chart 5.3 below illustrates the percentages of entities who will consider initiating R&D project within the coming 12 months.

Chart 5.3: Percentages of entities who would consider R&D projects within the coming 12 months



As for the entities who initiated R&D projects during the last three years, table 5.3 below illustrates the main indicators and data analyzed.

Table 5.3: Key indicators for the entities who engaged in R&D activities last three years

	Yes(%)	No (%)
The entity has a separate record for R&D expenditure	43	57
The entity has a separate unit for R&D activities	29	71
R&D activities are recorded as:		
Expenses	57%	
Investments	14%	
Partly as expenses and partly as investments	29%	

Table 5.4 below illustrates the key requirements and areas of interests and how the interviewed entities ranked their importance to their organizations when considering R&D.

Table 5.4: Key requirements and areas of interest when conducting R&D activities

Classification	Product Development (1)	Process Optimization (2)	Cost Reduction (3)	Productivity Enhancement (4)	Improving Quality (5)
1. Packaging	High	Moderate	High-Moderate	Moderate-Low	High
2. Light manufacturing					
2.1 Furniture	High	Moderate	High	Moderate-Low	High-Moderate
2.2 Plastics	High	Moderate	High-Moderate	Moderate	High-Moderate
2.3 Steel Fabrication	High	High	Moderate	Moderate	Moderate-Low

The above key requirements and areas of interest were identified by analyzing the data collected from the interviewed entities, where the ranking of the points (1&2) were categorized as High Demand, and the points (3&4) were categorized as Moderate Demand, while point (5) was categorized as Low Demand.

From table 5.4 above, it is noted that the highest demand was mainly in the area of product development while the lowest demand was in the area of productivity enhancement.

Table 5.5 below illustrates the entities, which participated in the R&D survey (demand side).

Table 5.5: All entities participated in the R&D Survey (demand side)

No.	Sector/Area	Company
1.	Plastics	Al Safa Plastics
2.	Plastics	North Fleet for Plastic Industries
3.	Plastics	Al Husam Plastic Industries
4.	Plastics	Al- Awael Company for Chiemco Plastic & Marketing Industries
5.	Plastics	Al Wafa Plastics
6.	Steel	Al Mashreq Steel and Manufacturing Co.
7.	Packaging	Al Tawfiq Factory
8.	Packaging	Al Aqsa International Manufacturing for Felling and Packaging Material
9.	Packaging	Technical Packaging Company
10.	Steel	Arab Iron and Steel Ind.
11.	Furniture	Jamil Sahouri and Bros. Co.
12.	Steel	ELBA House
13.	Packaging	The Arab Paper Converting and Trading Co.
14.	Steel	Najjar Industrial Trading Co.
15.	Furniture	The Jordan Insulation Materials Factory
16.	Packaging	National Canning Ind.
17.	Light Industries	Arab European Engineering Industries
18.	Furniture	Alameah for Carpets
19.	Plastic	Star Plastic Company
20.	Furniture	Arab Wavers Company
21.	Packaging	Jordan Sharief Company
22.	Packaging	Packaging Industries Company
23.	Furniture	Habaibeh for Furniture
24.	Furniture	Universal Wood Working Industrial Co.
25.	Furniture	World Wide for American and German Kitchens
26.	Furniture	Shadi Aluminum Kitchens Wares Factory
27.	Plastic	Petra Tapes Manufacturing Co.
28.	Plastic	United Establishment for Plastic Centenaries
29.	Plastic	Arab Medical Centenaries
30.	Steel	Steel – Mesh Industry
31.	Light Manufacturing-Furniture	Tabalat Kitchens
32.	Plastics	Sughayer & Marrar Industrial Co.
33.	Plastics	Ghufran Plastics
34.	Steel	Kalis - Expanded Metal Manufacturing Corporation
35.	Steel	Steel Fabrication Factory

R&D SUPPLY SIDE

The competencies of local Jordanian institutions in conducting R&D services is gauged through a survey which was sent to all public university deans of scientific research and to directors of some of the R&D centers. The focus on public universities is justified as private university research is very limited and can be classified as personal. The response rate is close to 60%, which can be considered good for such surveys. Although the time given to responders to fill out the questionnaires was more than two weeks and follow up was made by telephone from the second day they received the questionnaires to the end of day 18, some responded for some of the questions and others did not even respond. Some deans declined from the outset to participate on account that their universities were young and were not yet involved in R&D. One R&D center refused to participate on account that the questionnaire contained some (3-4) questions which were directed to universities. One of the most cited reasons mentioned for not filling out the questionnaire, by some of the respondents, was that the information was not readily available. This is, in essence, an indication of not giving enough attention to R&D, because this information should always be available and used for evaluation and enhancing R&D performance. In short the effort of collecting data from higher education institutions and R&D centers was tremendous but does hopefully fulfill the requirement of the survey.

The supply side questionnaire addressed six areas of interest. These are:

- Policy
- Personnel
- R&D Facilities
- R&D Activities
- Funding
- R&D Indicators

The respondents consist of eight universities (7 public and 1 private) and three research centers from a total of 19 higher education institutions and research centers. The complete list of the higher education institutions and research centers contacted for the survey is found in annex 8.4.

The following analysis summarizes the main findings of the responses.

Table 5.6 below gives an indication of the level of commitment to R&D in the R&D supply institutions.

Table 5.6: Commitment to R&D

	Yes (%)	No (%)
R&D is a priority	100%	-
R&D is adequate	-	100%
R&D incentives ok	36%	64%

As for the type of R&D activities conducted at the higher education institutions and research centers, about 30% of respondents perform basic research, about 20% perform applied research, about 10% perform testing and experimentation, and about 40% perform all types (basic, applied, testing and experimentation, and allied services). Chart 5.4 shows the percentages of R&D types in a graphical form.

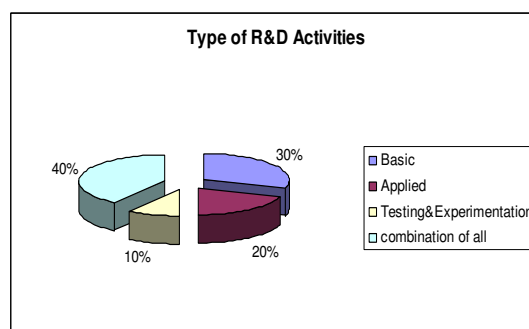
Chart 5.4: Types of R&D activities

Table 5.7 lists the respondents answers related to sabbatical leaves, centers of excellence, and faculty for each factory initiative.

Table 5.7: Treatment of R&D activities and initiatives

	Yes (%)	No (%)
Sabbatical leave for R&D only	75%	25%
Seek a status of center of excellence	88.9%	11.1%
Subscribe to doctor for each factory	88.9%	11.1%

The percentage of R&D budget with respect to the overall budget is an important indicator of commitment and seriousness in pursuing the goals of the institution. The answers to this question vary from as low as 2% to as high as 50%. Naturally the 50% figure indicates that the responding entity works primarily in R&D or it classifies its activities as such.

The ratio of personnel specialized in basic and applied sciences to total personnel is an indicator of availability of personnel for R&D activities. This ratio varies from as low as 30% to as high as 100%, which is a relatively good indicator. However, this should be coupled with availability of time and incentives for personnel to perform R&D activities. The availability of time works against R&D as none of the higher education institutions holds a "research only" post. As for the incentives

many respondents said they give incentives to researchers, but not all indicated how they split R&D proceeds. Only 36% of respondents indicated that they split R&D income with personnel. The portion paid to R&D personnel varies from as low as 20% to as high as 50%.

50% of respondents said that their institution is well equipped to perform R&D activities, and 50% said no. Of the respondents that believe they need improvements to enhance R&D performance, 60% said they needed everything (software and hardware, laboratory equipment, materials, testing facilities, time and money, and support personnel), while 40% said they only needed laboratory equipment and time and money.

Only one respondent indicated that they do not share any R&D facilities with other institutions and would not consider joint ownership of facilities in the future. About 20% of respondents said they do not share at the present time but they are willing to do so in the future. Finally a surprising 55% of respondents said they share R&D facilities now and will continue to do so in the future.

Only 36% of respondents indicated that they have R&D contracts with the local communities in their areas. The average number of R&D contracts varies from 3 to 5 to 15 per year (averaged over the past 5 years).

Table 5.8 is a major indicator of R&D competency in higher education institutions or research centers. It ranks in priority order the type of R&D activities according to the demand of the local communities, based on previous contracts.

Table 5.8: Ranking of R&D Competencies

	Pr. Develop.	Prob. Solving	M/feasibility	Prod. Enhanc.	Cost reduction	Quality impr.	Env./energy/water
University of Jordan	-	2	3	-	5	4	1
Yarmouk University	-	-	-	-	-	-	-
JUST	6	5	4	7	3	2	1
Al-Hashemiyah University	-	3	4	-	2	5	1
PSUT	-	-	-	-	-	-	-
Al-Hussein Bin Talal Univ.	-	-	-	-	-	-	-
Tafilah University	-	-	-	-	-	-	-
Amman University	3	4	1	7	6	2	5
HCST	4	2	6	3	7	5	1
Badia Research Center	5	1	4	2	7	6	3
Center for Biotechnology	1	2	1	2	1	2	3
Total	19	19	23	21	31	26	15
Overall Rank	Second	Second	Fourth	Third	Sixth	Fifth	First

Table 5.9 below lists the sectors which have the highest share of R&D contracts (or interest) with the various institutions and R&D centers. It is clear from the table that the industrial and agricultural sectors have the highest share of R&D activities from the responding entities. Next is the services sector followed by all the other sectors having the same relative share.

Table 5.9: Share of sectors from R&D activities

	Industrial	Commercial	Services	Agriculture	Env./Energy/Water	Medical	Social
University of Jordan	√	√	√	√			
Yarmouk University							
JUST	√			√			
Al-Hashemiyah University	√	√	√				
PSUT							
Al-Hussein Bin Talal Univ.							
Tafilah University							
Amman University	√	√	√	√	√	√	√
HCST	√		√	√	√	√	√
Badia Research Center				√	√		√
Center for Biotechnology						√	
Total Count	5	3	4	5	3	3	3

45% of respondents said that they have R&D contracts with international agencies, while 36% said they do not, and 19% did not respond. About 55% of respondents said that they have success stories through R&D contracts. This is a very encouraging indicator, which needs to be pointed out.

Charts 5.5 and 5.6 present the responses regarding local and foreign R&D funding respectively. In both cases the responses which indicated that they get local and foreign funding are almost half of the respondents. This is somewhat a good indicator, however, the question that needs to be addressed is: does entity funding alone suffices for R&D?

Chart 5.5: Local R&D Funding

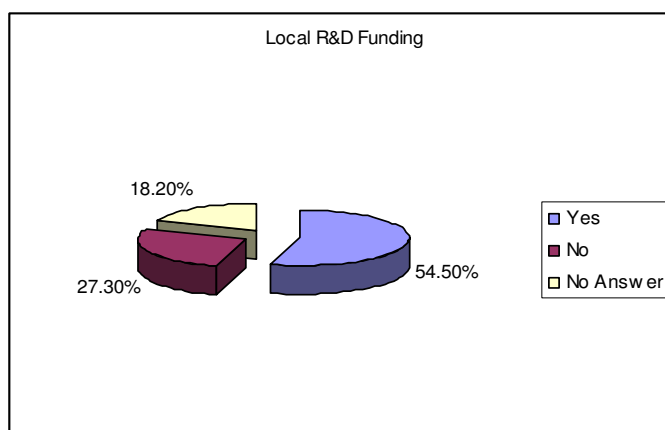
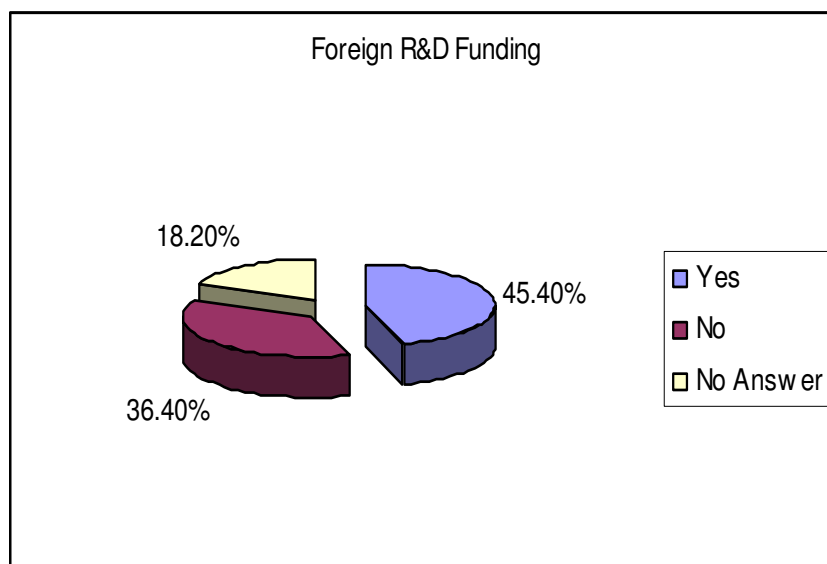


Chart 5.6: Foreign R&D Funding



81.8% of the respondents indicated that R&D funding (local or foreign) has shortfalls, while only 9.1% said no and 9.1% did not answer. From those who believe that R&D funding is inadequate 44.4% listed some specific reasons for the insufficiency of R&D funding. Some of the reasons include: 1) long delays for appropriating and depositing funds, 2) budget rigidity in terms of transfer from item to item, 3) lack of supplementary funds from private sector, 4) lack of coordination among R&D institutions and centers.

Table 5.10 below lists the R&D indicators of all higher institutions and R&D centers as viewed by the responders.

Table 5.10: R&D Indicators

	R&D FTE	Journal Publications/Yr.	Book Publications/Yr.	Patents/Yr.	R&D Sabbatical Leaves/Yr.	Sc.& Prof. Citations/Yr.
University of Jordan		200	15	10	120	200
Yarmouk University						
JUST		1/Faculty	18			
Al-Hashemiyah University						
PSUT		20	0	0	1-2	
Al-Hussein Bin Talal Univ.		20	2	0	2	30
Tafilah University						
Amman University		25	15	2	0	0
HCST						
Badia Research Center	30%	2		0	0	
Center for Biotechnology		0	0	0	0	

Finally table 5.11 below lists the areas of competence as seen by the respondents.

Table 5.11: Areas of Competence/Excellence

Institution/Center	Competence/Excellence
University of Jordan	1)Engineering, 2) Sciences, 3) Agriculture, 4) Pharmac
Yarmouk University	
JUST	1) Biotechnology, 2) Renewable energy, 3) Environmer
Al-Hashemiyah University	1)Energy, 2) Water and Environment, 3)Engineering
PSUT	1)Comp. science & graphics, 2) Elec. & Electronics, 3) Comp. Eng, 4) Comm. Eng., 5) e-business
Al-Hussein Bin Talal Univ.	1) Mining, 2) Basic Sciences
Tafilah University	
Amman University	1) Industrial pr. Solving, 2) Health, 3) e-learning
HCST	
Badia Research Center	1) Natural resources, 2) socio-economics, 3) Extension
Center for Biotechnology	1) Various fields of biotechnology, 2) Lab. tricks

SUPPLY AND DEMAND MATCH

An attempt was made through this survey to identify some common interests between the supply side and demand side. An analysis of tables 5.4 and 5.8 reveals that at the demand side there is some preference to the following issues:

- Product development
- Quality improvement
- Cost reduction

While for the supply side the competencies are concentrated on the following issues:

- Energy/water/environment
- Product development
- Productivity enhancement

There is a clear match between supply and demand in the area of product development. Moreover, if we consider productivity enhancement is strongly related to both quality improvement and cost reduction and vice versa, we can also claim a match in these respects as well.

The companies which have indicated this preference on one side and the higher education institutions which have such competencies are shown in table 5.12 below.

Table 5.12: Supply – Demand Match.

	R&D Demand		R&D Supply		
Product Development	Jordan Sharief Plastic Factory	Steel-mesh Industries	JUST		
Cost Reduction	Arab Wavers Factory		JUST	JU	HU
Quality Improvement	Al Husam Plastic Industries Co.	Jordan Sharief Plastic Factory	JUST	JU	HU

This match shown in table 5.12 above is only indicative, since the survey pointed out interests and competencies. Therefore, this tentative match between R&D demand and supply must be confirmed through a discussion session between the two groups. This is to be arranged by SABEQ in due course.

CONCLUSIONS

It is clear from the results presented in the analyses in the previous section that R&D activities as perceived from the demand side are less than desired. This could be attributed to the following:

- Lack of awareness of importance and influence R&D might have on the industrial processes
- Lack of awareness of local capabilities and competencies
- Insufficiency of funds from within the industrial firms or from other sources
- Absence of clustering among the industries of the same sector or sub-sector in problem solution or R&D issues
- No long term vision and future outlook of local industries regarding technological and market trends
- No track record of in-house or contracted research for almost all the targeted industries in the selected sample
- No success stories which could provide incentive or inspiration for others

On the other hand the R&D supply side believes the following regarding why R&D activities are as they are in Jordan:

- University professors are burdened with their teaching loads to have any part of R&D, unless it is related to the process of promotion
- Personnel of research institutions are directed to work on cash generating services, which take them away from R&D
- Lack of facilities in the higher education centers
- Lack of adequate funding
- No clear focus on competencies and areas of strength.

However, the potential for R&D activities is present. The most demanded areas of interest of the targeted industries are: 1) productivity enhancement, and 2) quality improvement. These are closely followed by: 3) cost reduction, and 4) process optimization. Unfortunately these priority requirements of the demand side are not exactly matched by the priority order of the supply side. The R&D supply side is interested in providing R&D services in other areas of interest. The reason for not finding a direct match between supply and demand could be attributed to the fact that the selected industrial sectors do not truly represent the industrial population.

Moreover, this matching issue could be looked at by studying the demand requirements versus areas of competence of the R&D service providers. Nevertheless, an attempt to produce some sort of a match between supply and demand was made and culminated in a meeting between a group from each side.

If this analysis is done, a match between productivity enhancement and quality improvement (as required by most targeted industries) and competency/excellence in engineering sciences is obtained. In other words the competency of R&D service providers in engineering sciences should equip the service providers to tackle productivity enhancement and quality improvement issues.

REFERENCES

1. Amman Chamber of Industry , Industrial Survey of Establishment , 2004 .
2. Department of Statistics. (Economic Survey, Internet Data)
3. Jordan Upgrading and Modernization Program (JUMP) . Study on Plastic Sector , Feb 2008 (Unpublished.)
4. Central Bank of Jordan,, Internet Data .
5. "Critical Review of R&D in Jordan", a study conducted for the United Nations Economic and Social Commission of Western Asia (UN-ESCWA) and co-sponsored by the United Nations Industrial development Organization (UNIDO), by Fawwaz Elkarmi and Isam Mustafa, 1995.
6. "Innovation Policy for Jordan", a study conducted for the Euro-Jordanian Action for the development of Enterprise (EJADA), by Fawwaz Elkarmi, 2005.
7. "Research and Development Strategy for Information and Communication Technology 2007-2010", Ministry of Information and Communication Technology, 2007.

ANNEXES

QUESTIONNAIRES (DEMAND SIDE)

Survey of Research and Development in the Packaging and Light Manufacturing Sectors

Research and Development (R&D) is the creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.

In fast moving industries, new product design and development is more than often a crucial factor in the survival of a company. Additionally, firms must continually revise their design and range of products. This is necessary due to continuous technology change and development as well as other competitors and the changing preference of customers.

A team of industry expert consultants in collaboration and coordination with the USAID-funded Sustainable Achievement of Business Expansion and Quality (SABEQ) program; are conducting field study in order to identify the research and development opportunities in the packaging and light manufacturing sectors.

(SABEQ) program is a broad-based economic development initiative implemented by BearingPoint, Inc. and an experienced team of international and Jordanian partner firms. By both supporting improvements in the business environment and providing assistance to expand innovation and productivity in Jordanian businesses, SABEQ's components all support the common objective of building up the private sector—Jordan's companies, innovators and entrepreneurs—as the most powerful engine of economic growth. One of those key SABEQ components is the **Enhanced Productivity Component**. This component connects directly with private sector with the following objectives:

- Enhanced competitive and innovative priority sectors through improved product and service offerings stemming from a more skilled workforce, and the application of globally-recognized best practices including sustainable technology.
- Increased market access and demand for priority sector products and services.
- Expanded capacity of targeted associations to serve as partners in sustainable economic transformation of the priority sectors.

This questionnaire will take approximately 20 minutes to be filled.

We would like to thank you for the valued time given to assist in achieving the desired goals and objectives of this study.

1. Does the organization manufacture at least some of its products on the basis of acquired knowledge?

- 1. Yes
- 2. No

2. Since 2005, did your organization engage in research and development as defined on the first page? (You may circle more than one response.)

- 1. Yes The establishment engaged in research and development.
- 2. Yes The establishment commissioned research and development from an external entity: a research institute or another manufacturing establishment
- 3. No The establishment did not engage in research and development and did not commission research and development from an external entity.

If the answer to the above question is No, please answer questions (14-21) only.

3. If the answer of question (2) above is Yes; does your organization keep a separate record of R&D expenditures?

- 1. Yes
- 2. No

4. Does your establishment have a separate unit for research and development?

- 1. Yes
- 2. No

5. What types of R& D your company is interested in? Please rank the following according to importance from 1 to 5, where 1 is very high, and 5 is not important.

- 1. Product Development _____
- 2. Process Optimization _____
- 3. Cost Reduction _____
- 4. Productivity enhancement _____
- 5. Improving Quality _____
- 6. Others (please specify): _____

6. How were research and development expenditures recorded in your bookkeeping system?

- 1. As expenses
- 2. As investments
- 3. Partly as expenses and partly as investments.

7. Please indicate the number of research and development projects your establishment engaged since 2005 _____ Please categorize these projects by their purpose. Circle the appropriate column, and add any comments you may have.

Project No.	In what way was the project innovative?				Was the outcome of the project:			Impacts that were felt after investing in the projects mentioned		
	New Knowledge	New Market	New Technology	New Material	New in the World	New in Jordan	New in the Company	Positive	Neutral	Negative
1										
2										
3										
4										

8. Number of persons employed in research and development – part-time _____/ full-time _____

9. Wages, salaries, and other expenses related to hiring workers specifically for research and development activities _____

10. Expenses for raw material and auxiliary materials used for research and development _____

11. Payment to external entities or subcontractors for carrying out R&D activity since 2005.

1. Below JD 10,000
2. JD 10,001 – JD 20,000
3. JD 20,001 – JD 40,000
4. Above JD 40,000

12. External funding (including grants) for research and development activities carried out since 2005: _____

13. Total investments in fixed capital (for R&D) carried out _____

14. What were the main reasons for not conducting an R&D in your organization?

1. Insufficiency of funds
2. Lack of skills / capabilities
3. Lack of resources
4. Others: _____

15. Would the utilization of current local raw material support the development of your organization when considering R&D?

1. Yes
2. No

16. Is/are the currently used machine(s)/tool(s) in your organization hindering the possibility to initiate R&D; means of old machines/tools?

1. Yes
2. No

17. Would you be confident to initiate an R& D project?

1. Yes
2. No

If the answer is No, please indicate what is needed to conduct an R&D for your organization:

If the answer is Yes, Please rank the following according to the importance to your organization from 1-5, where 1 is highly important and 5 is not important.

1. Product Development _____
2. Process Optimization _____
3. Cost Reduction _____
4. Productivity enhancement _____
5. Improving Quality _____

18. Do you know where to look for funding?

1. Yes
2. No

19. Is your organization interested in hearing about R&D opportunities?

1. Yes
2. No

20. Would you consider R&D Project for the coming 12 months?

1. Yes
2. No
3. Don't know

21. Change and Comments: List the changes that occurred since the investments in the R&D in your company if applicable and the expected changes that might occur when investing in R&D.

ANNEXES

QUESTIONNAIRES (SUPPLY SIDE)

Survey of Research and Development in the Packaging and Light Manufacturing Sectors

(Supply Side)

Research and Development (R&D) is the creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.

In fast moving industries, new product design and development is more than often a crucial factor in the survival of a company. Additionally, firms must continually revise their design and range of products. This is necessary due to continuous technology change and development as well as other competitors and the changing preference of customers.

A team of industry expert consultants in collaboration and coordination with the USAID-funded Sustainable Achievement of Business Expansion and Quality (SABEQ) program; are conducting a survey in order to identify the research and development opportunities in the packaging and light manufacturing sectors.

(SABEQ) program is a broad-based economic development initiative implemented by BearingPoint, Inc. and an experienced team of international and Jordanian partner firms. By both supporting improvements in the business environment and providing assistance to expand innovation and productivity in Jordanian businesses, SABEQ's components all support the common objective of building up the private sector—Jordan's companies, innovators and entrepreneurs—as the most powerful engine of economic growth. One of those key SABEQ components is the **Enhanced Productivity Component**. This component connects directly with private sector with the following objectives:

- Enhanced competitive and innovative priority sectors through improved product and service offerings stemming from a more skilled workforce, and the application of globally-recognized best practices including sustainable technology.
- Increased market access and demand for priority sector products and services.
- Expanded capacity of targeted associations to serve as partners in sustainable economic transformation of the priority sectors.

This questionnaire will take approximately 20 minutes to be filled.

We would like to thank you for the valued time given to assist in achieving the desired goals and objectives of this study.

Name of Institution: -----I.

Policy

1) Is R&D considered a priority in your institution?

☐ Yes ☐ No

2) Do you believe that your institution is doing enough R&D activities as it should?

☐ Yes ☐ No

3) Are R&D incentives adequate to encourage personnel to engage in R&D activities?

☐ Yes ☐ No

4) How do you classify R&D activities in your institution?

- ☐ Basic
- ☐ Applied
- ☐ Testing and experimentation
- ☐ Allied services
- ☐ Combination of the above

5) Is your institution's policy regarding Sabbatical leave restricted to R&D?

☐ Yes ☐ No

6) Does your institution share R&D income from R&D projects with R&D personnel?

☐ Yes ☐ No

7) How does your institution split R&D income with R&D personnel? -----%

8) Do you subscribe to the concept of specialization among Jordanian institutions in order to reach a status of "centers of excellence"?

☐ Yes ☐ No

9) Do you subscribe to the concept of "Doctor for each factory initiative"?

☐ Yes ☐ No

10) What is the percentage of R&D budget to total institute's budget? (average for last five years) -----%

II. Personnel

- 1) What is the number of Ph.D. holders in your institution? -----
- 2) What is the number of M.Sc. holders in your institution? -----
- 3) What is the ratio of Ph.D. and M.Sc.(higher degree) holders in basic and applied sciences relative to all other specializations? -----
- 4) Do you have a research post for any of your higher degree holders?
☐ Yes ☐ No
- 5) What is the number of full time graduate students studying basic and applied sciences per year (average for the last five years) -----
- 6) How many high degree holders were engaged in exchange/research programs with international institutes (average for the last five years)? -----
- 7) What is the percentage of graduating students' projects which could classify as R&D activity? -----

III. R&D Facilities

- 1) Do you think your institution is well equipped to perform R&D activities?
☐ Yes ☐ No
- 2) If the answer to Q1 above is "No" or you think that there is room for improvement, rank the following shortfalls according to priority:
--- Software and Hardware
--- Laboratory equipment
--- Materials
--- Testing facilities
--- Time and money
--- Support personnel
--- Others -----
- 3) Do you share R&D facilities with other institutions?
☐ Yes ☐ No
- 4) Would you consider joint ownership of facilities with other institutions as a possible solution to R&D facilities inadequacy?
☐ Yes ☐ No

IV. R&D Activities

- 1) How many R&D contracts with the local community does your institution have per year (considering an average for the last five years)? -----

(If the answer to Q1 is none go to Q4)

- 2) Rank the following type of activities according to the highest demand requested by R&D contracts? [1 is the highest and 7 the lowest]

- Product development
- Problem solving
- Market/feasibility studies
- Productivity enhancement
- Cost reduction
- Quality improvement
- Environmental/energy/water issues.

- 3) What sectors have the highest share of R&D contracts with your institution? Order according to priority

- Industrial
- Commercial
- Services
- Agriculture
- Others -----

- 4) Do you have R&D contracts with international agencies?

☐ Yes ☐ No

- 5) Do you have any success story through any of the R&D contracts?

☐ Yes ☐ No

Describe -----

V. Funding

- 1) Does your institution get local donor funds outside institute's budget for R&D?

☐ Yes ☐ No

- 2) Does your institution get foreign donor funds outside institute's budget for R&D?

☐ Yes ☐ No

3) Do you think R&D funding mechanisms have shortfalls?

☐ Yes ☐ No

4) For Q3 above list all limitations of R&D funding.

VI. R&D Indicators

1) What is the R&D full-time equivalent of your higher degree holders as per the HCST regular study of R&D capabilities in Jordan? -----

2) How many publications in international journals do your higher degree holders have per year (average for the last five years)? -----

3) How many books have been published by your higher degree holders per year (average for the last five years)? -----

4) How many patents have been registered for your higher degree holders per year (average for the last five years)? -----

5) How many Sabbatical leaves have been spent on R&D activities per year (average for the last five years)? -----

6) How many scientific and professional citations have your higher degree holders received per year (average for the last five years)? -----

7) What are the areas of competence/excellence of the R&D capabilities of your institution?

1) -----

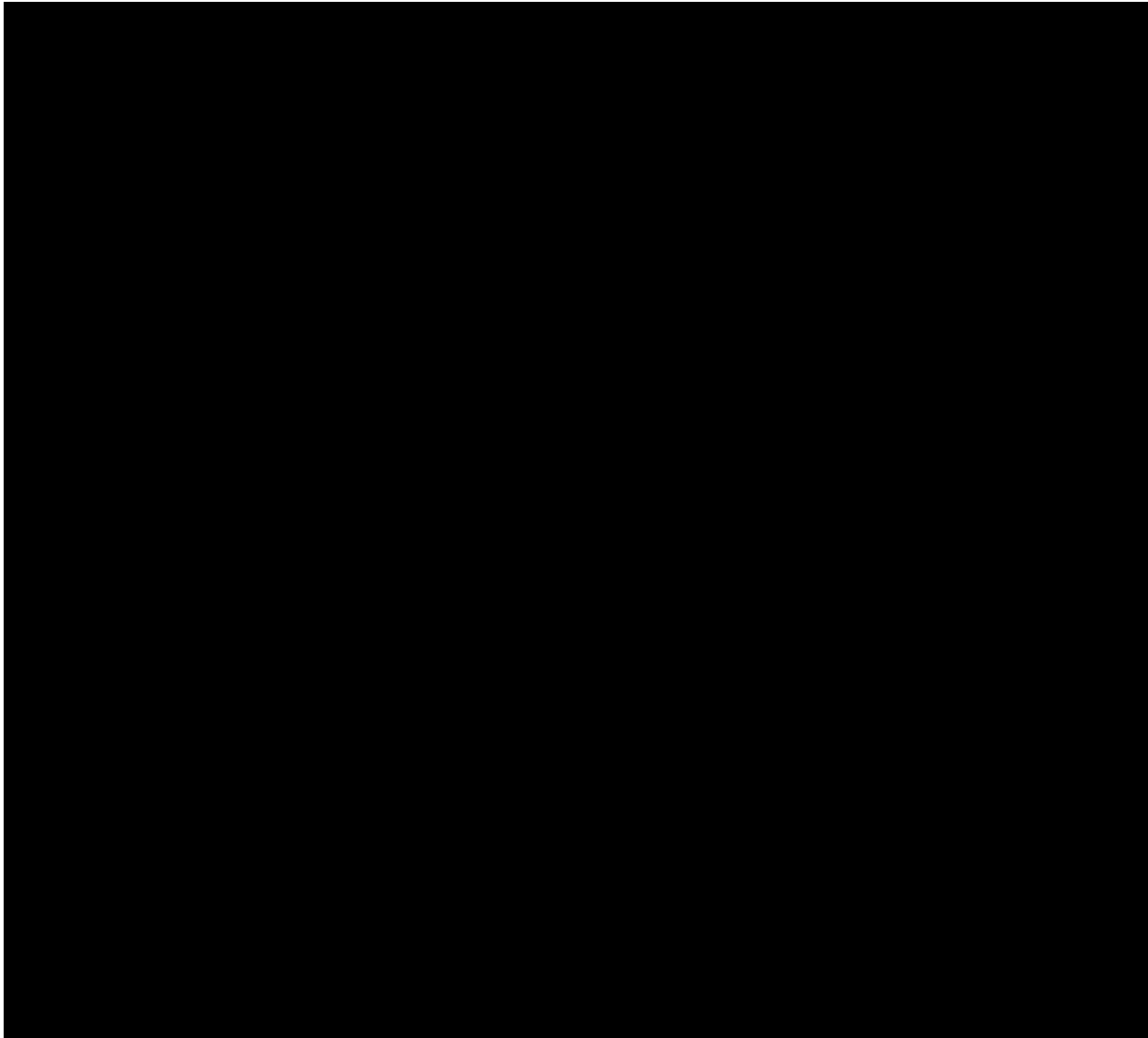
2) -----

3) -----

ANNEXES

LIST OF INDUSTRIES INVOLVED

Garden Furnitures and Accessories	Carpets, Rugs, Mattresses	Home Furniture (Kitchen, Bedrooms, etc...)	Hospital and Lab furniture	Houseware Products	Office Furniture
Arab Plastic Furniture Manufacturing Establishment	ATALLAH ZABANEH & PARTNER Co.	Middle East Bedding Manufacturing Co./THER.A.PEDIC	Abdel Rahim Commercial Agencies	AL QUDS PLASTICS Co.	Abdel Rahim Commercial Agencies
Kassim Al-khudairy & Partner Co.(Savana)	Al-Karnak Trading Co.	National Foam Factory	Abdin Industrial Est.	AL-TAJ ALUMINIUM FACTORY	Abu Layla Sons Co.
Orient Plastic Co.	Al-Quds For Cotton & Textile Industries Factory	Orient Treasures Mills	Abu Layla Sons Co.	Ahli Plastic Factory Co.	Al-Behar Industries Co.Ltd.
	Arab Foam Factories Co.	Union Mills for Yarn And Carpet (UMYC)	Al-Behar Industries Co.Ltd.	Al Wafaa Plastic Establishment	Ali Al-Jamal & Partners Co.
	Arab Pioneer Carpets	United linens & Textiles Co. Ltd	Ihsan & Tahseen Baalbaki Co.	Al-Faisal Industrial Co.	Altaj office furniture Industrial Company
	Arab Textile Factory	Woollen Industries Co. Ltd	Jordan Catering Supplies Corporation	Al-Tayseer for Trade & Industrial Investment Co.	Altaelah Furniture
	Arab Weavers Factory Co.	Anton Kayyal & Sons Trading Co.	Pro-Tech Establishment	Arab Plastic Furniture Manufacturing Establishment	Anton Kayyal & Sons Trading Co.
	Arabian Poly Propylene Fibre Co. Ltd.	Arab Green House Manufacturing Co. Ltd.	Trans - Orient Construction Supplies	Arabisque Ceramics	Arab Green House Manufacturing Co. Ltd.
	Bahaa Mustafa and Partners Co.	Arab Home Appliances & Electronic Industries Establishment		Askar Industrial Foundation	Ayoubi Steel Furniture Factory
	Global Carpet And Rug Industries	Arab Technical company for plastic		Farouk Jabsheh & Sons Co.	Distinctive Industrial & Trading Co.
	Kolaghassi Foam & Mattress Factory Co.	Awar Food Service & laundry Equipment		Golden Star for Plastic Factory	Forum Furniture Co. Ltd.
	Lana Spring Mattress	Dahdal Industrial Trading Co. (ROMO)		Jordan Aluminium & Copper Manufacturing Co.	Industrial House Of Decoration
	Middle East Bedding Manufacturing Co./THER.A.PEDIC	Forum Furniture Co. Ltd.		Jordan Aluminium Plating & Manufacturing Co.	International Factor General Lathing
	National Foam Factory	Ibrahim Abdin & Partners Co. / Danish Kitchen		Jordan Narrow Fabric Co. (Manneh Industrial Group)	International Co. for Manufacturing Office Furnitures
	Orient Treasures Mills	Industrial House Of Decoration		Jordan Ornamin Co.	Issam Company
	Union Mills for Yarn And Carpet (UMYC)	International Factor General Lathing		Jordan Plastics Co.	Jordan Universal Wood Industries
	United linens & Textiles Co. Ltd	Issam Company		National Plastics Co.	Jordan Wood Industries Co./JWICO
	Woollen Industries Co. Ltd	Jamil Sahouri & Brothers Co.		Orient Plastic Co.	Lebanon Furniture Co.
		Jarash Factory For Electrical Home Appliances		PETRA TEXTILE INDUSTRIES	MAANI & PARTNERS FURNITURE CO.
		Jordan Catering Supplies Corporation		Pioneers Plastics Co. Ltd.	MAHMOUD AND ZAHADA AL-KHALILI (MABCO)
		Jordan Plastics Co.		Shadi Aluminium Kitchen Wares Factory	Philadelphia For Wood Furniture Industries Co.
		Jordan Universal Gas Cookers and Washing Machines (Universal)		Suliman Al-Sayed & Sons Co.	Rum-Aladdin Industries Co. Plc.
		Jordan Universal Wood Industries		Sultan Plastic Industrial Co.	Sader Brothers Co.
		Jordan Wood Industries Co./JWICO		Tabalat For Aluminum Kitchen	Sami Habaibeh And Sons Co. for Furnitures Manufacturing wood
		Kamil Khoury & his Brother Co. (Emad Furniture)			Sheltered Workshop & Training Center/Young Muslim Women's Association
		Kassim Al-khudairy & Partner Co.(Savana)			Specialised Furniture Establishment
		Khatib Carpentry & Decoration Co.			Trans - Orient Construction Supplies
		MAHMOUD AND ZAHADA AL-KHALILI (MABCO)			Universal Wood Working Industrial Co.(UNICO)
		Middle East Complex Engineering Electronics and Heavy Industrial Plc (MEC)			
		Orient Plastic Co.			
		Rum-Aladdin Industries Co. Plc.			
		Sader Brothers Co.			
		Sami Habaibeh And Sons Co. for Furnitures Manufacturing wood			
		Sheltered Workshop & Training Center/Young Muslim Women's Association			
		Tabalat For Aluminum Kitchen			
		The American Kitchen Co.			
		Universal Wood Working Industrial Co.(UNICO)			
		World Wide For American & German Kitchen			
		Zahi Darwazah & Partners Co.			



ANNEXES

LIST OF UNIVERSITIES AND R&D CENTERS INVOLVED

No.	Institution	Contact	E-mail/Tel.
1	Jordan University	Prof. M.Azzam	azzamm@ju.edu.jo 0795043480
2	Yarmouk University	Prof. Sami Mahmood	Mahmmods@yu.edu.jo 0777588823
3	Jordan University for Science& Technology	Prof. Fawzi Banat	banat@just.edu.jo 0795134952
4	Princess Sumaya University for Technology	Prof. A.Y. AlZoubi	zoubi@psut.edu.jo 0777355299
5	Hashemite University	Prof. Mousa Mohsen	msmohsen@hu.edu.jo (05) 3903333 ex. 4147
6	German-Jordanian University	Dr. Hani Abu Qdais	Hani.qdais@gju.edu.jo 5300666 ex.280
7	Mu'tah University	Dr. Mohammad Salem Al-Tarawneh	darmutah@yahoo.com 0795011113
8	Tafila Technical University	Dr. Saleh Al-Jufout	drjufout@yahoo.com (03) 2250326 ex. 1017
9	Al-Al Bayt University	Dr. Hani Akho Rashida	Consulting@alalbait.aabu.edu.jo (02) 6297000 ex. 2751
10	Al-Hussein Bin Talal University	Dr. Hatem Widyan	widyan@ahu.edu.jo 0777625336
11	Al-Balqa' Applied University	Prof. Abdallah Al-Zoubi	Al-zoubi@bau.edu.jo (05)3532392
12	Amman University	Prof. Moayyad Al-Douri	md_@yahoo.com (05) 3500211 ex.2410
13	Royal Scientific Society	Dr. Khaled Kahhaleh	kahhaleh@rss.gov.jo 53444701
14	National Center for Agricultural Technology Research	Dr. Faisal Awawdeh	Director@ncartt.gov.jo 0777781170
15	Higher Council for Science & Technology	Prof. Anwar Al-Batikhi	info@hcst.gov.jo 5340401 ex.206
16	National Center for Energy Research	Eng. Malek Kabariti	Malek.kabariti@nerc.gov.jo (079)5581131
17	National Center for Biotechnology	Prof. Usama Al-Khaldi	info@ncb.gov.jo 53540401
18	Badia Research Center	Eng. Mohammad Shahbaz	brdp@hcst.gov.jo 5335284/5335280
19	National Center for Diabetes, Endocrinology & Genetics	Prof. Kamel Al-Ajlouni	ajlouni@ju.edu.jo 0777603603

Sustainable Achievement of Business Expansion and Quality
Salem Center, Sequleyah Street
Al Rabieh, Amman
Phone: +962 6 550 3050
Fax: +962 6 550 3069
Web address: <http://www.sabeq-jordan.org>