

Saudi Arabia's Western Region Cement Production, Demand and Cost Analysis

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ABSTRACT. This paper presents a detailed analysis of the various aspects of cement (production, demand, costs, etc.) in the Western Region of Saudi Arabia which contains more than 35% of the total population of the Kingdom (*i.e.*, most populated region). A background information about the cement industry of the whole Kingdom is also presented.

The region's cement demand rose in 1983 to 8.1 million tons representing about 40% of the country's total demand. However, the demand went down to 3.9 million tons in 1988, but it still constituted 40% of the country's demand. Meanwhile, the cement production in the region is unable to meet the regional demand, and the shortage is met through import from the country's other regions or from abroad. A seasonal variation for cement demand has been observed. As demand slows down in the last four months of the Higi calendar

1. Introduction

Portland cement is a relatively new construction material not only in the Kingdom of Saudi Arabia but also in other Gulf countries. The first cement plant in the area was built in Iraq in 1949^[1]. Ten years later, the first cement plant in the Kingdom of Saudi Arabia was constructed in Jeddah with a capacity of 300 tons/day. This industry continued growing in the Kingdom since then until the actual cement production reached about ten million tons per year in 1988. It is worthy to mention that in mid 1970's inadequate supply of cement in Saudi Arabia hindered and delayed many of

the economic development projects. However, at the same time it attracted the attention to the shortage in national cement production in Saudi Arabia, particularly, in the presence of enough national revenue and cement raw materials.

At present there are eight cement plants operating in the Kingdom of Saudi Arabia. The location of these plants region-wise as well as the population density are shown in Fig. 1. There has been a spectacular rise in the demand for cement during the last thirty years in the Kingdom, rising from a mere 100 thousand tons in 1958 to more than 16 million tons at the end of the third development plan in 1985, passing by a peak in 1983 where the demand reached a figure of more than 20 million tons. The present installed capacity of about 13.9 million tons of cement is dispersed all over the country, so that there is a minimum cost of transportation of cement from one place to the other. Except for the Saudi-Bahraini and Saudi-Kuwaiti Cement companies, where the Saudi Government shares are 85% and 55%, respectively, all other companies are Saudi public limited companies^[2-6]. Due to the fact that cement

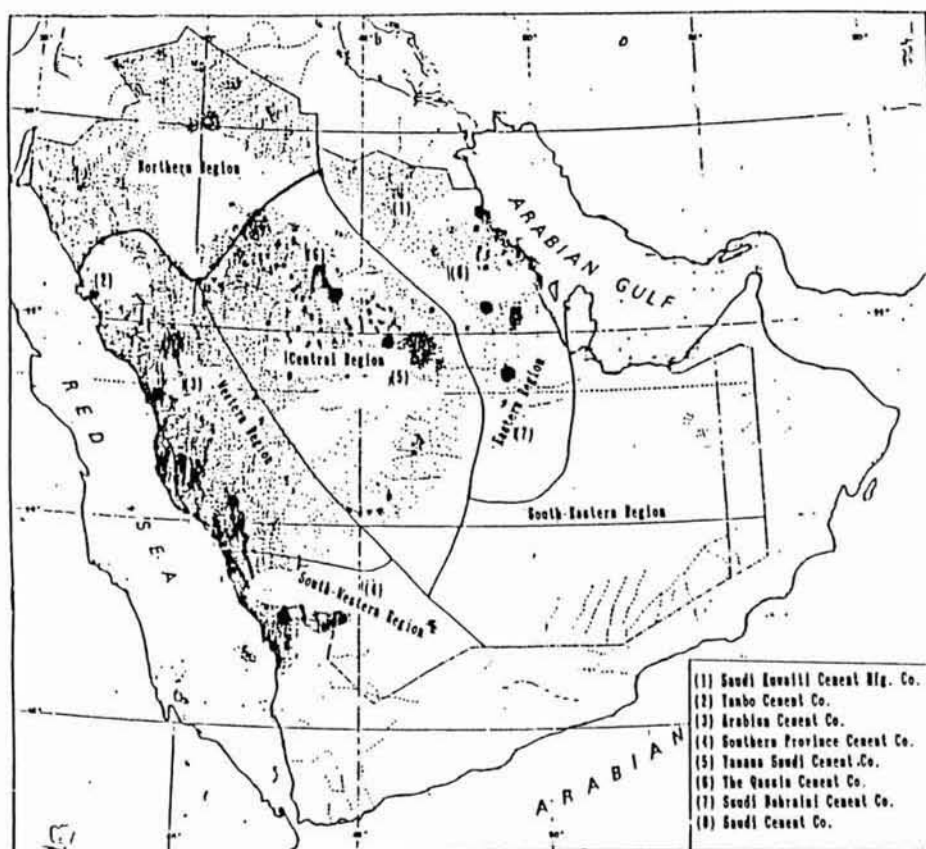


FIG. 1. Region-wise population density and locations of cement plants in the Kingdom of Saudi Arabia.

is a low value-to-weight ratio product, the location of a cement plant with respect to the marketing areas and raw material location should be given enough consideration to minimize the transportation cost. The demand for cement in a certain region is affected by several factors, some of which are :

1. Population density.
2. Major construction projects (government and private).
3. The economic and social status of the population.
4. Encouragement of citizens, by the government, for private housing construction (the Saudi Real State Fund carries this responsibility on behalf of the government).

A cement plant was about to be constructed in the Northern Region, specifically, in the Duba area under the name of Tabouk cement company (with a daily production capacity of 2200 tons), but due to economic as well as other considerations the project was not approved. It was perhaps a very wise decision to stop this project. The capacity of the plant was very small compared to other cement plants, which would have made the overhead cost of the plant relatively high. Furthermore the demand for cement in the region can be covered by the nearby cement companies (in Yanbu and Qassim) or by international suppliers (from Jordan and Iraq). The small capacity of the plant was an indication of the low demand of the region.

Cement Production and Demand Region-wise

The capacity, actual production, and demand of each of the four cement producing regions are shown in Table 1. From this table and Fig. 1, it is obvious that there is a notable relationship between cement demand and population in these regions. The two most populated regions, Western and Central, have a demand of about 80% of the cement in the Kingdom. The rate of demand as well as population density in the Western and Central Regions are very similar (Fig. 1 and Table 1). From the above

TABLE 1. Cement capacity, production and demand in Saudi Arabia by regions (thousand tons/year).

Year	Western			Central			Eastern			South-western		
	Capacity	Production	Demand	Capacity	Production	Demand	Capacity	Production	Demand	Capacity	Production	Demand
1983	1545	1501	8186	2508	2425	8568	3427	2878	2380	1650	1402	1768
1984	1545	1475	7908	2508	2363	8275	3427	2505	2261	1650	1434	1708
1985	2526	2214	6596	2508	1737	6606	5627	4380	1863	1650	1421	1456
1986	2526	2130	5286	2508	2113	5438	5627	3361	1542	1650	1581	1181
1987	2526	2151	4640	2598	1615	4758	5627	3337	1392	1650	1346	1047
1988	2526	3113	3866	4063	2300	3977	5627	3000	1142	1650	1000	868

information one can observe the following facts :

1. Cement plants in the Western Region, *viz.*, Arabian Cement Company (ACC) and Yanbu Cement Company (YCC), are working at almost full capacity. This indicates that the market in the Western Region can absorb whatever can be produced from the existing plants. For example, in 1986, the demand for cement was more than double what was produced by the regional plants. The difference between the demand and local production is getting less with time.

2. Cement plants in Central Region are in similar situation as that of the Western Region. Yamama Saudi Cement Company (YSCC) before 1986 was producing clinker at a rate above its installed capacity which reflects the high demand for cement in the region at that time^[7].

3. Cement plants in the Eastern Region operated at about 50% of its installed capacity in 1987^[7]. This low efficiency increased the per ton cost of cement. Some of these companies market a fraction of their production in Riyadh area as a result of the rail road facilities to Riyadh area which is a good sign of regional cooperation and coordination.

The location of three cement plants in Eastern Region with a total capacity close to 60% of the total cement produced in the Kingdom was not a wise decision for the following reasons :

a. The area is close to UAE where local demand is way less than the local production. The excess production is finding its way easily to the Eastern region market at very cheap price, below production cost.

b. Local market in the Eastern Region, by all means, cannot absorb all the local production (population density is low compared to other regions in Saudi Arabia).

c. Exporting cement to other neighbouring Gulf Cooperation Council (GCC) countries is out of reach due to dumping of foreign cement by other cement producing countries.

4. There is one cement plant in South-western Region, Southern Cement Company. In the early 80's the cement demand of the region was way higher than the local production, and cement had to be imported to fulfil this shortage. Now-a-days, local cement production in this region is in excess of local demand and the plant has started exporting clinker to other countries. The geographical and topographical nature of the area, where the plant is located, makes it difficult to export cement out of the region through local transportation avenues.

5. There are no cement plants in Northern region. The demand of this region is covered by plants in Western and Central Regions or from Jordan.

This paper deals mainly with the cement status (production, demand and costs, *etc.*) in the Western Region of the Kingdom of Saudi Arabia. Detailed study of the production rate and analysis of production cost for the two cement plants in this region, Arabian Cement Co. (ACC) and Yanbu Cement Co. (YCC) will now be presented.

Western Region Cement Production and Demand

For strategic, historical, religious, and meteorological reasons the Western Region of the Kingdom of Saudi Arabia became the most populated area in the Kingdom. While more than 35% of the Saudi population lives in the Western Region, which is less than 15% of the country's area, the cement production in the region is not more than 33% of the total cement production in the country. In addition, several of the Governmental and private heavy construction projects have been going on in this region for more than ten years which caused initial shortage of cement in the region. The difference between the demand and the production was either imported or provided by the neighbouring regions, *i.e.*, Central or South-western region. The Western Region is an exception from all regions in the Kingdom from the point of view of cement production and demand^[8]. The total production continued increasing until 1986 when it stabilized at about 2.1 million tons per year then it increased again till it reached about 3.1 million tons in 1988. The demand decreased from 8.1 million tons in 1983 to an average of 3.9 million tons in 1988 (Fig. 2). This means that cement was continuously flowing into the Western Region to satisfy the region's need.

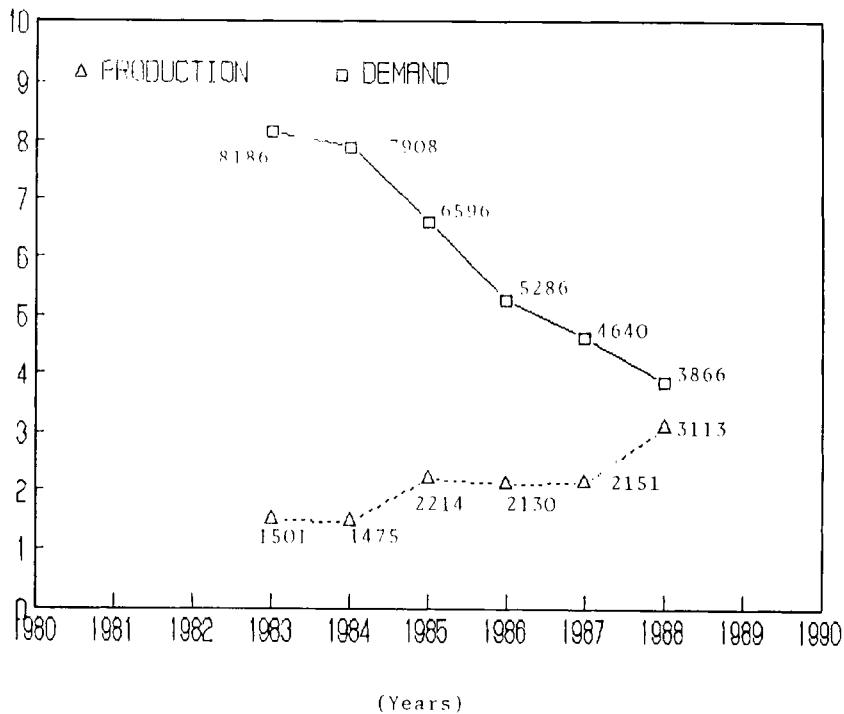


FIG. 2. Cement production and demand (million tons) in the Western Region for the year 1983-1988.

As a matter of fact, the rate of cement demand in the Western Region is not uniform around the year. For obvious reasons, there are four months (in the Hijri Calendar) Ramadan, Shawal, Zul-Qidah, and Zul-Hijjah, when the construction activities are relatively slow and the cement demand is about 0.6 million tons less than the average. In the rest of the year the cement demand is about 0.4 million tons more than the average demand. In both cases demand is higher than production, and the region used to get the needed amount by importing or from the neighbouring regions. However, it is not recommended to expand any of the present plants nor to build a new plant in the region. This is because the total cement production in the Kingdom will soon exceed its need. In addition, the per capita demand of cement in the Kingdom is relatively high and most probably will stabilize in the future once the big construction projects in the country are completed.¹⁹¹

A detailed account of cement plants in the Western Region follows :

1. Arabian Cement Company (ACC)

The Arabian Cement Company was the first cement plant built in the Kingdom. It was originally located in Jeddah, the main sea port in the Kingdom. The plant started production in 1959 with an installed capacity of 300 metric tons per day. The dry process was adopted in this plant using a long rotary kiln fired by fuel oil. One year later, a short rotary kiln equipped with a rotary clinker cooler and with a capacity of 100 metric tons per year was added for producing lime. The plant faced some marketing difficulties during its first year and a good portion of the second year of production.

The ACC expanded twice before its relocation in Rabigh in 1984. The first expansion was completed in 1969 by adding a second cement kiln of 600 metric tons capacity per day. The second expansion was completed in 1975 with an additional installed capacity of 1000 metric tons per day.

The plant faced some difficulties after its last expansion. These difficulties may be summarized as follows :

1. Limestone reserves on the surface near by the plant were depleted and the company had to mine below water table level, which increased the cost of limestone and decreased its quality and, hence, increased the production cost of cement.
2. Part of the limestone reserves extend into an area which is now housing King Abdulaziz International Airport.
3. The city of Jeddah was expanding rapidly and the area around the plant became residential.
4. The cement flue was excessive and the plant was a source of heavy environmental pollution.

Because of the above mentioned reasons a decision was taken to abandon the old site and build a new plant in Rabigh.

a) Production Capacity at (ACC)

The new plant was erected in Rabigh about 100 kilometers to the north of Jeddah.

The production of the new plant started on 23rd of December, 1984. The installed capacity of the plant was 1,260,000 tons per year and the actual was 1,320,000 tons per year. In this dry process plant, the calcination section of the plant consisted of four long rotary kilns and produced two types of cement, *viz.*, ordinary and sulphate resistant. No expansion of the plant has been carried out in Rabigh since it was constructed in 1984. The plant is selling cement both in bags and in bulk. Table 2 shows the sale of each type as well as the clinker production during the years 1985-1988. One may notice that the ratio of the bulk of the bagged cement is progressively increasing from 1985 to 1988 which may reflect on the size of the construction projects in the area.

TABLE 2. Nature of finished product (bag-bulk) and clinker production for ACC. (weight expressed) in thousand tons/year).

Nature of product	1986		1987		1988	
	Weight	%	Weight	%	Weight	%
Clinker	627.696	75	638.775	71	1,007.821	58
Bulk	213.462	25	335.033	29	723.211	42
Clinker	1,299.203		1,225.177		1,162.281	

The increase in cement sales in 1987-88 reflects the restrictions imposed on the goods imported to the Kingdom in the same year by increasing the custom's tariff. The ACC total finished product in 1987 increased by about 16% of its amount in the previous year (1986), and the production of finished product in 1988 was more than double that of 1986. The clinker stock piled before 1987 was used to partially fulfil the increased demand of cement.

b) Manpower at ACC

The manpower in the ACC plant is divided into three main categories: managerial and administrative, production and service workers. Each category is further sub-divided into Saudi and non-Saudi employees. The operation and maintenance (O & M) of the plant is contracted. The number of contractees are on an average about 450 workers. Table 3 summarizes the information about the manpower in ACC over the years 1985 to 1988.

Table 3 reveals several essential aspects. The Saudi employees in the managerial and administrative positions are more than seven times that of the non-Saudies which agrees with the general policy of Saudizing the top level positions in the country. The expatriates in production category out-number the national workers by more than five times. This reflects the attitude of the Saudi youth towards working in remote areas where the cement plants are usually located. In addition, the percentage of the Saudi workers in the production category, being on an average about 2%, is an indication of the lack of skilled Saudi labour in this industry. This needs attention from the top management to encourage and train Saudis to replace expatriates

TABLE 3. Distribution of manpower in ACC.

Year	Total	Managerial				Production				Services			
		Saudi		Non-Saudi		Saudi		Non-Saudi		Saudi		Non-Saudi	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1985*	545	47	8	44	8	12	2	119	22	52	10	271	50
1986	101	14	14	2	2	2	2	11	11	41	40	31	31
1987	101	15	15	2	2	2	2	11	11	41	40	30	30
1988	98	15	15	2	2	2	2	8	8	41	42	30	31

*For 1985 the numbers include contractor's company's workers relating to O & M, whereas for the rest of the years these are excluded.

in this field. It is worth mentioning that the ACC is one of the few cement plants in the Kingdom that have a well established training center at the plant site. The percentage of Saudis in the service category is small compared to the Non-Saudis if we include the contractees.

c) Financial Aspects at ACC

The cost of cement production involves several cost elements, each of which will be discussed separately. The percentage cost distribution for producing one ton of cement at ACC during the period from 1985 to 1988 is shown in Table 4. These percentages indicate that the cost structure of producing one ton of cement by the company is almost fixed with the exception of few items. The cost of spares and grinding media is continuously increasing. This is due to the increase in the amount of finished product, termination of guarantee period, and continuous wear of parts with age. The average packaging cost per ton fluctuates between SR11 and SR14. It was SR14, 11, 13, and 13 in the years 1985, 86, 87 and 88, respectively¹⁷. Salaries reduced, percentage-wise, in the year 1988 in comparison with the previous two years although the number of workers did not change. This may be attributed to the company's trial to reduce the overall cost via increasing work efficiency. The depreciation cost is the highest cost element of the total production cost. Percentage-wise it represents about 42% of the total cost of production. This is expected due to the fact that cement is a capital intensive industry. It is particularly so in the developing countries. Furthermore, the ACC plant is relatively a new plant, only four years old.

Cement industry is an energy intensive industry. However, energy cost is not as high in Saudi Arabia as it is in other countries. This is basically due to the fact that energy for heavy industry is subsidized in Saudi Arabia. The cost of fuel in ACC accounts for about 17% of the total cost in each of the past four years. This by all means is a low percentage when compared to the other cement exporting countries such as

TABLE 4. Distribution of production cost percentage-wise at ACC.

Cost selling elements	Year			
	1985*	1986	1987	1988
O & M** contract	18	19	17	17
Depreciation	39	42	42	40
Fuel & lubricants	17	17	17	17
Spares & grinding media	2	3	5	6
Packaging	6	4	5	8
Raw material**	2	2	2	2
Fire bricks and chains	2	2	2	2
Salaries	9	8	7	6
Indirect cost	2	1	1	1
General administration & selling cost	3	2	2	1
Total	100	100	100	100

*Figures of year 1985 for 9 months only.

**Operation and maintenance.

*** Cost of raw material not mined by the company itself. Cost of raw material mined by the company are split between depreciation and maintenance.

South Korea and Spain, where the cost of fuel and power accounted for 45.3% and 39.4% of the total cost of cement production, respectively, in 1986^[10].

The cost of raw materials is low compared to the cost of the other elements. The listed costs of raw material in Table 4 represents only those materials that are not mined by the company itself such as clays, iron ore and sandstone. The other raw material constituents such as limestone and gypsum are available in sufficient amounts at the plant site and are quarried by the company which reduces the transportation as well as the total costs. The cost of raw materials mined by the company is split between depreciation and maintenance items. The cost per ton of the raw material components used at ACC for cement production in 1988 and the relative

cost of the components per ton of finished product for the same year are shown in Fig. 3 and 4, respectively.

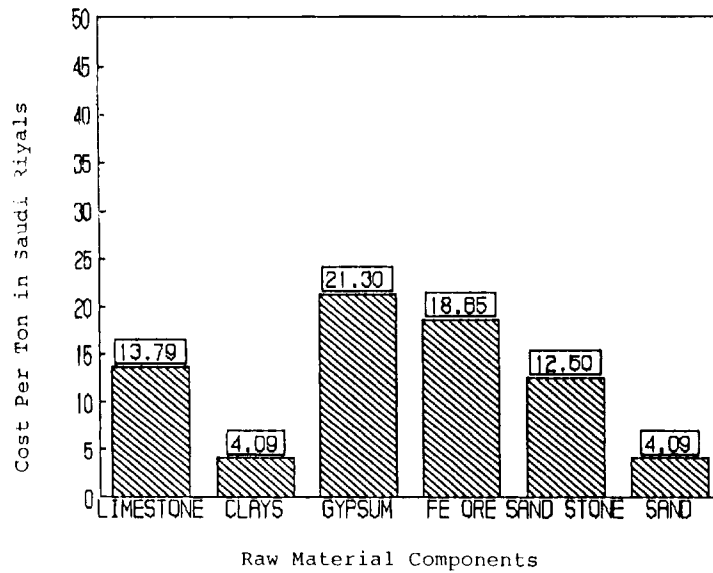


FIG. 3. Cost per ton of the raw materials components at ACC in 1988.

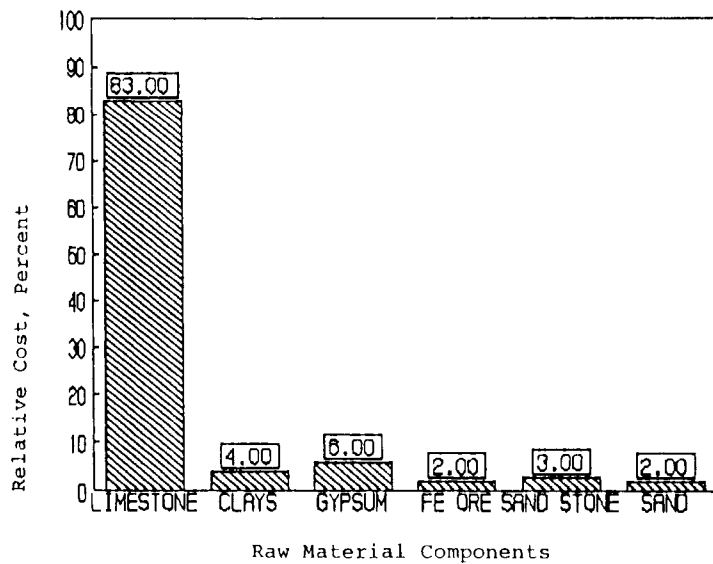


FIG. 4. Relative cost of the raw material components at ACC in the year 1988.

2. Yanbu Cement Company (YCC)

Yanbu Cement Company is located in the Industrial City of Yanbu, about 350 km north of the city of Jeddah. The plant started production in 1981 with a yearly installed capacity of 900,000 tons of clinker. It uses the dry process technique in the production of cement. At the start, the plant had two long kilns, and in 1985 an additional long kiln was added which increased the plant capacity to 1,200,000 tons of clinker per year.

a) Production Capacity at YCC

The plant produces two types of cement, ordinary (76% of the total production) and sulfate resistant cement (24% of the total production), and uses fuel oil for thermal energy. The actual production of cement for the years 1982-1988 are shown in Table 5. In the years 1982 and 1983 the plant operated below its full capacity^[9]. In the years 1984 through 1988 the plant was producing more than its installed capacity of finished cement to fulfil the market demand. This extra finished product was ground from the stock piled clinker. In the last three years, more than 40% of the total finished cement was sold in bulk. This indicates that the customers of the YCC are contracting firms engaged in big projects.

TABLE 5. Nature of finished product (bag-bulk) production for YCC (weight expressed in thousand tons / year.)

Nature of product	1982		1983		1984		1985		1986		1987		1988	
	Weight	%	Weight	%	Weight	%	Weight	%	Weight	%	Weight	%	Weight	%
Bags	7907.3	91	8067.8	84	796.6	82	1077.2	73	644.4	50	663.3	56	776.3	56
Bulk	079.3	9	155.1	16	170.1	18	402.5	27	644.6	50	514.5	44	606.2	44

b) Manpower at YCC

The actual numbers and percentages of employees and workers in each category during the study period (1982-1988) are presented in Table 6. Few observations on the manpower information may be highlighted. Until 1984 there were no Saudi employees in the company. In 1988, the Saudi employment reached 7.5% of the total work force. The Saudi managerial and administrative staff are only 3.4% of the total work force. The ratio of the production workers to the total work force in YCC is the highest of all the Saudi cement firms^[7]. It ranges from 72.9 to 85 percent. The percentage of the Saudi workers in the production category never reached 1.6% of the total numbers of workers in that category. It should be mentioned that the running (operation and maintenance) of the plant is contracted to an Indian company due to lack of Saudi trained manpower. Until 1984, there was no Saudi employee in the service category. However, in 1986 the percentage of Saudis in the service category jumped to about 19% of the total number of the service workers.

TABLE 6. Distribution of manpower in YCC.

Year	Managerial administrative				Production labour and staff				Services				Total
	Saudi		Non-Saudi		Saudi		Non-Saudi		Saudi		Non-Saudi		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
1982	-	-	24	4	-	-	448	84	-	-	63	12	535
1983	-	-	21	4	-	-	450	84	-	-	62	12	533
1984	-	-	20	4	-	-	455	85	-	-	63	11	538
1985	6	0.1	47	7.33	2	0.05	493	76.91	16	2.5	77	12	641
1986	6	1.52	53	8.10	4	0.06	495	75.57	17	2.60	76	11.6	651
1987	22	3.35	67	10.2	9	1.37	469	71.49	17	2.59	72	10.98	656
1988	22	3.37	65	9.97	10	1.53	468	71.78	17	2.61	70	10.74	652

*The summation of the two numbers in those columns represents the O & M Contractor's Company's workers.

c) Financial Aspects at YCC

The breakdown of YCC plant cost elements in percent during the period from 1984-1988 is given in Table 7. As has been mentioned the operation and maintenance (O & M) of the plant is contracted to an Indian company since the start of the operation of the plant. The cost of contracting the O & M is almost fixed around 16% of the total cost. The percentage production cost distribution shown in Table 7 reflects the stability of the cost structure of producing one ton of cement with few exceptions. There is a marked drop in depreciation in the last two years from an average of 40% of total cost to the low value of 30%. The YCC may have started using a different depreciation rate in the last two years in order to reduce its per ton cost for competition purpose with the other cement factories in the Kingdom. Although the 40% is comparable with some Saudi cement firms, the depreciation percent in some other Saudi cement firms goes upto 47% of total production cost^[7]. The total production cost of the plant during the last two years dropped by 25% due to this calculation manoeuvring. The other observation is that the ratio of the spare and grinding media is gradually increasing. This could be attributed to the increasing frequency of maintenance due to age and over loading of the plant. The same could be said about the increase in the fire bricks and chains cost element. The cost of energy in Saudi Arabia is low compared to non-oil producing countries as mentioned earlier while discussing ACC. This is basically due to the fact that energy for heavy industry is subsidised in Saudi Arabia. The cost of raw material is low compared to the cost of other major cost elements. This may be due to the availability of major constituents of raw materials in sufficient quantities near the plant site, which in turn reduces the transportation costs. The plant runs its quarries for limestone and gypsum and contracts for the rest of the raw materials needed. Figure 5 shows the cost per ton of each of the raw materials used during the year 1988. Figure 6 shows the percentage contribution of each type of raw material components to the overall cost of the raw materials in the

TABLE 7. Distribution of production cost percentage-wise at YCC.

Cost selling elements	Year				
	1984	1985	1986	1987	1988
O & M** contract	16	14	15	16	16
Depreciation	45	43	44	31	31
Fuel & lubricants	13	13	14	16	16
Spares & grinding media	4	5	5	7	7
Packaging	7	7	4	10	10
Raw material**	3	4	5	2	2
Firebricks and chains	2	3	4	7	7
Salaries	3	2	3	3	3
Indirect cost	2	2	1	2	2
General administration & selling cost	5	5	5	6	6
Total	100	100	100	100	100

*Operation and maintenance.

** Cost of raw material not mined by the company itself. Cost of raw material mined by the company are split between depreciation and maintenance.

same year. The cost of limestone is about 57% of the total raw material cost. Limestone accounts for about 82% of the total raw materials used to produce one ton of cement^[7].

3. Comparison between the Two Cement Plants in the Western Region

The two cement plants were built by the same consulting company, Humboldt Wedag AG of West Germany (WHD). The technology in both of them is the same, *i.e.*, long dry kiln. However, Yanbu plant was constructed about four years before the new ACC plant at Rabigh and most of the problems faced during the construction of the YCC plant were avoided during the construction of the ACC plant, which is one advantage in favour of ACC. The other advantage is the long experience of ACC managerial staff while they were operating and managing the ACC plant at Jeddah.

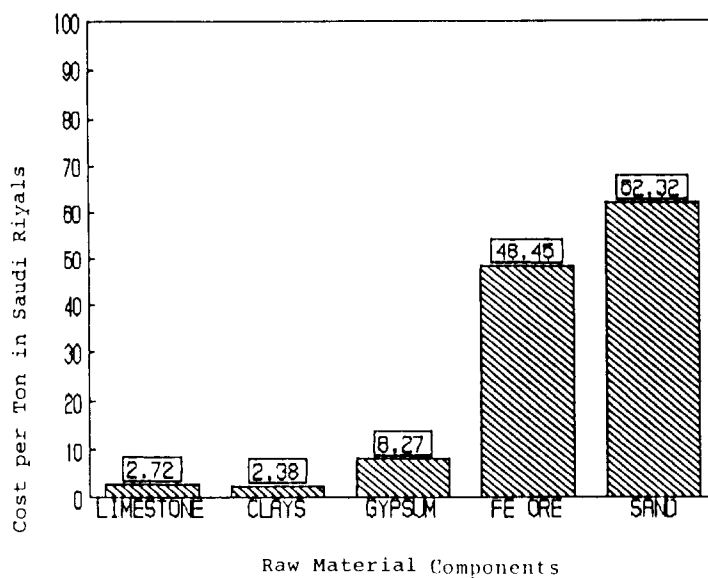


FIG. 5. Cost per ton of each of the raw material components used at YCC 1988.

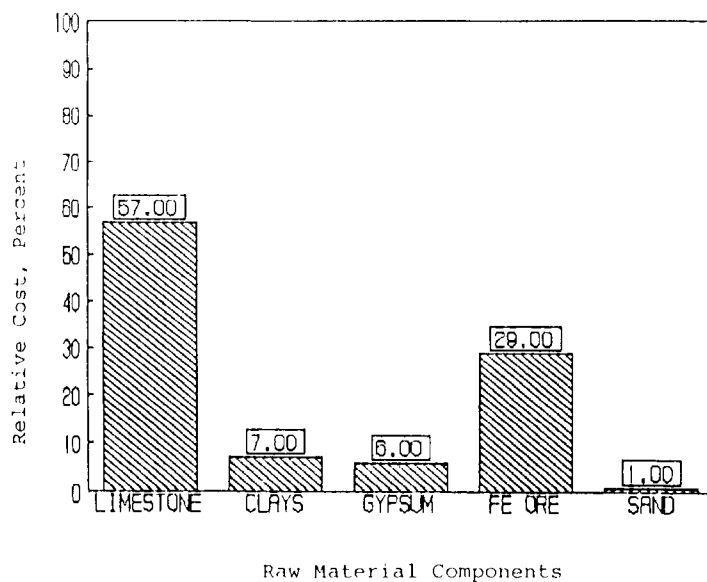


FIG. 6. Relative cost of raw materials per ton of finished cement at YCC.

The per ton costs of cement for the two plants are almost the same except in the last two years, when the YCC changed their method of calculating the depreciation share of the total cost (Table 8). In the last two years the per ton cost of cement produced by YCC has dropped sharply by about 25% of its previous level. This drop was caused merely by changing the policy of the company in computing the yearly depreciation. In other words, this drop does not reflect a real achievement in cost reduction. The productivity of the two plants, as defined by tons per man-day, is almost the same for the two companies with a marginal increase in favour of ACC, probably due to higher automation level (Table 8).

TABLE 8. Comparison between the production aspects of the ACC and YCC plants (1986-1988).

Year	Clinker production in thousand tons		Employment		Productivity [†] t/man-day		Per ton cost in SR	
	ACC	YCC	ACC ^{†*}	YCC	ACC	YCC	ACC	YCC
1986	1299	1250	551	651	7.86	6.53	143	149
1987	1225	1250	552	656	7.40	6.57	141	112
1988	1262	1234	547	652	7.08	6.53	141	113

[†]Based on 300 working days/year

^{†*}See comments under Table 3.

Another element that is worth comparing between these two plants is the cost distribution as well as the total cost of the raw material constituents. The total cost of raw materials per ton of produced cement is SR25.5 and SR9.4 for ACC and YCC, respectively^[7]. That is, the raw materials at ACC costs more than twice that at YCC. A close look at Table 9 shows that this range difference in raw materials cost is concentrated in the cost of limestone, although limestone is quarried by the company in both cases. Also, there are differences in the cost of gypsum, iron ore, and sand. The source of gypsum is very close to the location of YCC which reduces the cost per ton of this material. Sand and iron ore are transported from distant locations, Al-Ula (north of Al-Madinah) and Wadi Fatima (east of Makkah), respectively to the YCC plant, whereas the sand and iron ore sources are not very far from ACC at Rabigh.

Cement plants in Western Region are operating at full capacity which might indicate or suggest that they are in a very good shape from the financial point of view compared to other plants in the Kingdom. The problem of the stock piled clinker which was produced before 1987 has been solved by the recent customs regulations in the Kingdom – the increase in custom tariff. This was evident from the over production of finished product due to heavy demand on the national cement. ACC in 1988 produced more than 37% above its installed capacity of finished product by using the stock piled clinker produced in previous years, while YCC produced about 15% above its installed capacity in the same year. With all this, the original demand still could not be met locally. An important fact may be mentioned here is that the two plants will go back to producing only upto its installed capacity, or little more,

whenever the stock piled clinker is depleted. This is not an invitation for capacity expansion of cement plants in the region, but it is for the sake of comparison between the cement plants in the Kingdom and it is a call to redistribute the cement distribution zones in the Kingdom at least for the time being to allow other national companies to close the gap.

TABLE 9. Raw material cost at ACC and YCC in 1988.

Raw material	Cost/ton, SR			
	Raw material		Cement produced	
	ACC	YCC	ACC	YCC
Limestone	13.79	2.72	21.25	4.26
Clays	4.09	2.36	0.95	0.53
Gypsum	21.30	8.27	1.51	0.44
Iron ore	18.65	48.45	0.50	2.00
Sand	4.09	62.32	0.50	2.21
Sandstone	12.50	–	0.75	–
Total SR	–	–	25.46	9.40

Conclusion

This paper has presented an overview of the cement production in the Kingdom of Saudi Arabia and a detailed analysis of the working cement plants in the Western Region.

There is a strong relationship between regional population density and its cement consumption. The two heavily populated regions (Western and Central) accounted for more than 80% of the total country's demand in 1988. However, their production capacity was less than 50% of the total production capacity of the Kingdom. The capacity of the Eastern region is about five times more than its regional demand. This in fact reflects the existence of an imbalance between the regional demand and production capacity. The apparent short fall in cement supply in the Western region, however, does not call for an increase in its production capacity as it can be met from the excess capacity of neighbouring regions.

The two plants in the Western region one in Yanbu and one in Rabigh, were built by the same company, their technology is the same long dry kiln and they produce the same type of cement, ordinary and sulfate resistant. Their per ton costs of cement are also almost same. However, in the two years, 1987 and 1988, the per ton cost of Yanbu plant dropped by about 25%. This drop in the per ton cost was not due to a real achievement in cost reduction. It was caused merely by changing the policy of the company in computing yearly depreciation. In reality, depreciation accounts for more than 40% of the total production cost in the two plants.

The labour productivity of the two plants are almost same with Rabigh plants doing slightly better. The operation and maintenance of the two plants is contracted to international companies which reflects the very low percentage of Saudis in the production labour category. In the managerial category the Rabigh plant is doing a better job in saudizing the top management level compared to the Yanbu plant. More than 88% of the managerial and administrative staff in the Rabigh plant are Saudis compared to less than 26% in the Yanbu plant.

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إنتاج واستهلاك وتكلفة الأسمنت بالمنطقة الغربية بالمملكة العربية السعودية

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المستخلص . يقدم هذا البحث تحليلاً مفصلاً عن النواحي المختلفة لصناعة الأسمنت (الإنتاج ، الطلب ، التكلفة ، . . .) . بالمنطقة الغربية من المملكة العربية السعودية ، والتي يقطن بها أكثر من ٣٥٪ من سكان المملكة ، وتعتبر أكثر المناطق ازدحاماً بالسكان . كما يقدم البحث أيضاً معلومات عن صناعة الأسمنت بصفة عامة في المملكة .

في عام ١٩٨٣م ارتفع الطلب على الأسمنت بالمنطقة الغربية إلى ٨,١ مليون طن ، أي ما يعادل ٤٠٪ من الطلب الكلي للبلاد . ومع أن الطلب انخفض إلى ٣,٩ مليون طن في عام ١٩٨٨م إلا أنه لا يزال يعادل ٤٠٪ من إجمالي الطلب الكلي على الأسمنت بالمملكة . ولما كان إنتاج المنطقة من الأسمنت لا يغطي الطلب ، مما استدعى تغطية هذا النقص عن طريق الاستيراد من داخل أو خارج المملكة . وقد لوحظ أن الطلب على الأسمنت بهذه المنطقة فصلياً ، حيث ينخفض في الأربعة شهور الأخيرة من السنة الهجرية .