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RESEARCH PAPER

Deriving Brick Demand Equation for Brick Kiln industry of North Sindh

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ABSTRACT

Brick is the main input for house construction and house is the final product of brick kiln industry. Many variables affect demand of house i.e. labour, brick price, brick substitutes, brick compliments, consumer numbers, taste, technology, future price of brick, transport and weather costs. Cobb Douglass Production Function is used to derive brick house Demand Equation. It is type of production function in which technological relationship among inputs and also between inputs and output is represented. Total used bricks at house (Y) is dependent variable and input costs to manufacture that house are independent variables, i.e. x1, x2, x3, etc. in this model. Eleven natural log independent variables are used. Results are at adjusted at R^2 value of 0.99 with significant model ANOVA. Except one all variables are significant Technology Cost is insignificant. Brick price, PR2, weather cost, labour cost and technology have negative relation with house demand. House is normal good as income coefficient is positive.

KEYWORDS: Brick, Brick Kiln Industry, Cobb Douglass Production Function, Demand Equation, Demand, House, North Sindh

Introduction

Brick is the most essential element of the construction. Brick is input for house construction and house is the final product. So demand for bricks is factor or derived demand.

Bricks are demanded seasonally and produced and consumed mostly in summer time. Concentration and capacity of work in a town determines the overall brick demand for that town.

Housing requirement for people of Pakistan increases 70000 units in a year. (NPHP) There are around 5 persons living per housing unit.

Brick demand has the multiplier effect on the growth of a nation. It represents construction industry. The biggest factor that affects brick demand is its **price** in the market. Market for bricks lies between perfect competition and oligopoly. It is close to perfect competition. Brick price is determined based on its cost and pull (demand) from market. Many players are involved in this chain of distribution. Brick Kiln value chain consists of

Laborer-----producer-------Sales Agent-------Transporter--------Consumer

Taste plays vital role in the brick demand. Owner of the house decides on the tastes / constituents for house before construction even begins. Other factors that decide taste of consumer can be summed as *Kacha* vs *Pacca* house, House storey, House area and Quality of bricks.

Brick demand is affected by the **annual income** of the owner of house being constructed.

Construction labour is the most crucial factor of production. Labour has been accorded a lot of rights in laws. This is the most inevitably tricky and confusing to control / manage them to achieve target.

Transporting bricks to the construction site is not the responsibility of the kilns. House owner orders and pays tractor trolley labour to bring required orders (usually 5000 bricks each order) on site. Sometimes he buys in retail and other times he buys directly from kiln in whole sale quantity. Storage or **inventory** management for the owner is a big problem that's why he buys in batches.

Brick demand is affected by change in the price of compliments or substitute. Cement manufacturing has industrial importance. It is under control of cartel. The decision to buy bricks can be delayed if the **cement mix price** (including steel price)is too high. Cement mix consists of cement, Roro, Bolari, poder, sand, krash, and steel. House also requires ceramics, wood, stones etc for its completion.

Government gives growth initiatives specially during expansionary economic phases. Taxes on housing are reduced and official loans are given to boost construction sector. Housing taxes include stamp duties, land revenue tax, sales tax, etc. The rate of land is officially decided by authorities.

Brick demand is affected by the duration of construction project (house) because with time all the costs increase. This has effect on the overall demand for the house.

There are natural variables/factors that too have effects on the brick demand. Construction work can be affected by storms, rain, etc.

Table1
factors which affect demand

Price	Taste	cement mix cost	Government growth initiatives
Substitute	Compliments	Taxes	weather cost
Brands	house area	inventory / stock cost	duration of work
future price	loan requirement	Bulk Buying	Income
labour cost	house storey	transport cost	type of house

Normal demand function is

$$Qd=a -bP \pm cM \pm d_1P_{r1} \pm d_2P_{r2} +eT +fP_e+gW +hT_r+iT_{ech}+jL+kN+u$$

b,c,d1,d2,e,f,g,h,i,j and k are coefficients of demand equation for bricks

Literature Review

Pakistan is third largest producer in south Asia. Pakistan urbanization has been increasing at the rate of 10% per annum. This has given impetus to make more and more bricks. (Kaleemullah sheikh et al., Sindh 2020)

Abdalla et al ,Sudan, 2012, have observed that Khartoum city is expanding during last 50 years. Agricultural land is decreasing around Khartoum. The ratio of built up land to agriculture land has increased from 2.0 in 1972 to 4.7 in 2009. This has increased demand of bricks. Kilns are in competition with agricultural land utilization. Kilns can t operate, usually, from July to September due to Nile flows. (Abdalla et al, 2012)

Important constituents/resources for brick making are compacted and loose cow dung, water clay, and fuel wood. 2800 million bricks were made in 2006. Total number of kilns in 2005 in Sudan stands at 3450 out of which 2000 are in Khartoum, capital of

Sudan. There are total 35000 employees in kiln industry with 50% employed at Khartoum region. (Abdalla et al, 2012)

Annual 36 t wood fuel was burnt in Khartoum kilns and the population of Khartoum was 5.3 million residents. Annual emissions by burning fuel was about 25752000 t. and 10% emissions were added by kilns with additional 0.5% contributed by wood burning kilns. (Alam& Starr, 2009). This high contribution to emissions by kilns is due to higher demand of red bricks. (Abdalla et al, 2012)

Bricks are consumed by individual house builders or construction agencies. Small construction agencies get bricks from dealers while large agencies have direct supply contract with kiln owners. Methods employed to check quality of bricks (Siriman Naveen et al, 2016) are,

- Checking randomly ,
- Dropping the product (brick) from some height,
- Taking colour of brick as measure of quality
- Checking by machine

More a brick is red higher is its quality. There is no formal demand requirement from market and determined by kiln owners based on their experience. Also there is no assured supply of bricks for consumers. Among these uncertainties and trust deficits it is necessary to have brick value chain network functional and upgraded for the benefit of all stakeholders. Upgrading value chain will lead to ILO decent work at kilns. (Siriman Naveen et al, 2016)

Material and Methods

It is part of PhD research. 100 recently built houses are selected and questionnaire form III is got filled by survey method. The sampling is non random purposive with focus on target districts of North Sindh. Three district are selected i.e. Sukkur, Larkana, and Khairpur.

Cobb Douglass Production Function is used to derive Demand Equation. It is type of production function in which technological relationship among inputs and also between inputs and output is represented. Total used bricks at house (Y) is dependant variable and input costs to manufacture that house are independent variables, i.e. x1, x2, x3, etc. in this model. CDPF tells about returns to scale for the kilns, relative share of all the input costs for the house. Variables' parameters/coefficients , beta 1, beta 2…… represent elasticity coefficients. It is used to check factor intensity. It is used to calculate average physical product and MPP of inputs. MRTS can be calculated easily.

Table 2
costs or factor responsible to construct a house

Labour cost	Brick Price	Wood /block / ceramics, etc	Cement Mix	Transport cost	Installation cost (Technology)	Future Price	Weather Cost	Annual Income	Taste

1.Labour Cost: There are many types of labour who work at house being constructed. Broad categories are *Mistri* (Special labour)and *Mazdoor* (Ordinary labour).

Mistri (specialized construction labour): There are four types of Mistris who work at house i.e.

Table3
Mistri labour at house

For 1000 feet square Ideal house construction

S.No.	Mistri type	Quantity	Work Detail	Helper mazdoors (Q)	Daily income	Total days work	Total income
1	Osariwaro	1		2to 3	1200	30	
2	Palasterwaro	1		1 to2	1200	30	
3	Shatingwaro	1		1 to 2	1200	10	
4	Iron Fitter	1		1 to 2	1200	20	

Mazdoors: These are not skilled ones. Their income is lower as compared to Mistri. Following are types of Mazdoors employed at house being constructed.

Table4
Ordinary Labour at house

For 1000 feet square Ideal house construction						
S.No.	Mazddor Type	Quantity	Work details	Daily income	Total days work	Total income
1	Cement Mix maker	1		600	all days	
2	Brick carrier	1		600	all days	
3	Osari helper	2		600	with OsariMistri	
4	Iron binder helper	1		600	with Mistri	
5	Palaster helper	1		600	with Mistri	
6	Shating helper	1		600	with Mistri	
7	Digger	2		600	Initial days	

Brick Price: final weighted average one brick's price is calculated.

Formulas used are

Total Brick Quantity = sum of bricks of each type of brick

Total cost of bricks = sum of costs of all types of bricks bought

Average Order Size = Total brick Quantity/total orders

Average order cost = Total Cost of bricks/total orders.

3.Wood, block, Ceramics Cost: It is cost of wood, blocks, ceramics, etc used along with bricks. It is asked in the questionnaire form.

4. Cement Mix: Cement Mix is sum of following items used in house construction

Cement	Steel	Krash	Sand	Bolari	Roro	Poder

Cost of cement mix will be calculated as

Table5
Cost of cement mix calculation

Cement Mix Item	Order Procurement Mode	Orders or Quantity Bought	Rate per order	Total cost
Cement	Bags			
Steel	Kilograms			
Krash	Trolleys			
Sand	Trolleys			
Bolari	Trolleys			
Roro	Trolleys			
Poder	Trolleys			

Transport Cost: It will include transport cost of orders of bricks, all items of cement mix, wood, ceramic, blocks etc.

Total transport cost = sum of transport costs of bricks , cement mix etc

Total transport orders = sum of transport orders of bricks , cement mix etc

Average transport Cost = total transport cost/ total transport orders

Installation cost (Technology): This cost will include sum of following heads

Motor Cost	Map Cost	Tools rented

Based on rate and quality tools rented are tayshi, karni , Gaz, Shayni, Sha'ni, Hammer, Big Hammer, Dhamak, Tagari, Belcha, Teekam, Kodar, wheelbarrow, panjhar (for ceiling surrport), etc. In the questionnaire form all these tools are not asked. House builder is asked to provide a lump sum figure in rupees he spent on tools for rent.

Future Price: It will be saved amount of cost of bricks due to buying in bulk. Following data will be asked in the questionnaire.

Bulk buying	Total Orders	Total Saved/lost Rs due to Bulk Buying

Average Rs saved per order = Total Saved Rs/ Total orders

Weather Cost: It will include sum of following costs

Table6
weather cost items

Days Rained	per day loss	Rain loss
Storm Days	per day loss	storm loss
Sick Labourers	Sick Days	Sickness loss

Following formula will be used to find Total Loss

Total Loss = Rain Loss+ Storm Loss+ Sickness Loss

Annual Income: It will be asked in the questionnaire form.

Taste: This variable can be calculated based on the use of quality bricks in the construction of house. There are two types of bricks normal / ordinary and Bhelli bricks. Normal bricks include Qisti, Roof, NavSha and Dhero. There are no any Bhelli bricks in these denominations which are required for the house construction. Bhelli bricks which are used are actually from Qisti form.

Following heads and formulas will be used to find Taste Cost.

Table7
taste cost calculation

First Class Bricks (Q, %)	Orders	Second Class Bricks (Q,%)	Orders	Difference between First Class and second class brick %
First class Brick Usage (over used or under used)	Average First class Order Cost	Bhelli Order Cost	Taste Cost (Rs)	Overall cost (Increase or decrease)

Following formulas will be used to calculate above indicators

Difference between First Class and second class brick % = First class bricks % - Second class brick % usage

Taste Cost = (1^{st} Class orders - 2^{nd} class Orders)* (Average 1^{st} class order Cost – Bhelli Order Cost)

Consumer Number: it will be asked in questionnaire.

Deriving Demand Equation: Cobb Douglas production function in non linear simple form can be written as

$Q = \beta_0 X_1^{\beta 1} X_2^{\beta 2} \ldots\ldots X_{11}^{\beta 11}$

This function has to be formed in linear form because it will be easy to analyse further. Linear form of CDPF is

$\ln Q = \ln\beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 \ldots\ldots B_{11} \ln X_{11.}$

(: ln = natural log) , (: Q= Dependent Variable), (: $\ln\beta_0$ = Y intercept) ,

(: X1…….X9 =Independent variables), (:β1…… β9 = coefficients)

$\ln Q = \beta_0 - \beta_1 \ln P_+ \beta_2 \ln M + \beta_3 \ln P_{r1} + \beta_4 \ln P_{r2} + \beta_5 \ln T_+ \beta_6 \ln P_{e+} \beta_7 \ln W + \beta_8 \ln Tr + \beta_9 \ln T_{ech+} \beta_{10} \ln L + \beta_{11} \ln N$(Equation I)

Variables: Q= Brick demand, P= brick price, M=Annual Income, P_{r1} = Price of related Good 1, P_{r2} = Price of related Good 2 T =Taste, P_e = Future price, W=weather, Tr = Transport, T_{ech}= Technology/Installation, L = labour, N=Consumer Number

Coefficients: ($\beta_1$to β_{11})

Data for CDPF is compiled in MS Excel for all houses survedy, e.g.

Table 8
Regression variables

	Y	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11
S.No.	Brick demand	Price	Income	P_{r1}	P_{r2}	Taste	Future price	Weather	Transport	Tech	labor	Consumer No.
1												
2												
3												

This table (with data values) will be converted into natural log form and then regression in SPSS statistical software will be run.

CDPF final equation: Error term will be added to equation I to get statistical CDPF model.

$\ln Q = \beta_0 - \beta_1 \ln P \pm \beta_2 \ln M \pm \beta_3 \ln P_{r1} \pm \beta_4 \ln P_{r2} + \beta_5 \ln T_+ \beta_6 \ln P_{e+} \beta_7 \ln W + \beta_8 \ln Tr + \beta_9 \ln T_{ech+} \beta_{10} \ln L + \beta_{11} \ln N + u$ (Equation II)

CDPF Hypothesis forming

At aggregate level (Regression model s overall significance is tested)

H_0: $\beta_1 = 0$, $\beta_2 = 0$... $\beta_{11} = 0$ (i.e. there is no relation between x and y variables at all)

H_1: ≠0 (It means at least one of the independent variables shows a relation with dependent variable.)

Hypotheses (At individual level)

H1: Price of bricks has sufficient impact on brick demand

H2: Annual Income has sufficient impact on brick demand

H3; Price of related good 1 has sufficient impact on brick demand

H4: Price of related good 2 has sufficient impact on brick demand

H5: Taste has sufficient impact on brick demand

H6: Future price has sufficient impact on brick demand

H7: Weather cost has sufficient impact on brick demand

H8: Brick transport cost has sufficient impact on brick demand

H9; Technology has sufficient impact on brick demand

H10: Labour cost has sufficient impact on brick demand

H11: consumer number (in market) has sufficient impact on brick demand

R square of model, significance level of all coefficients got in regression, etc is to be analysed.

Results:

Costs and benefits of a house constructed are

Table9
House Brick Demand Cost Analysis

House Size	Large	medium	Small
Income	2084000	1200345	1002610
Taste	305000	250000	150000
Futurecost	-60000	-30000	-22000
consumerNumber	6	5	8
House construction Costs			
BricksUsed	90760	70612	52033
Brickproce	7.9	8	8.5
brick total cost	717004	564896	442281
pr1Substitutes	1520400	1595878	1307867
pr2Compliments	67600	59844.4	60966.7
Weather	50440	46133.3	33000
Transport	230000	195000	178557
Technology	18640	17533.3	16033.3
Labor	5045069	3305600	2500000
Total cost	7649153	5784885	4538704

Labour Cost: There are two types of labour who work at house being constructed i.e. ordinary and special(*Mazdoor and mistri*)

Compliments:Pr 2 is compliment. It includes sum of costs of 4 construction materials i.e. blocks, stones, wood and ceramics. All are not used at a time in one house. Blocks are not used in North Sindh in house construction.

Substitutes:Pr 1 is substitute. It includes sum of costs of seven construction materials i.e Cement, steel, krash, sand,Bolari,Roro and poder. All are not used at a time in one house.

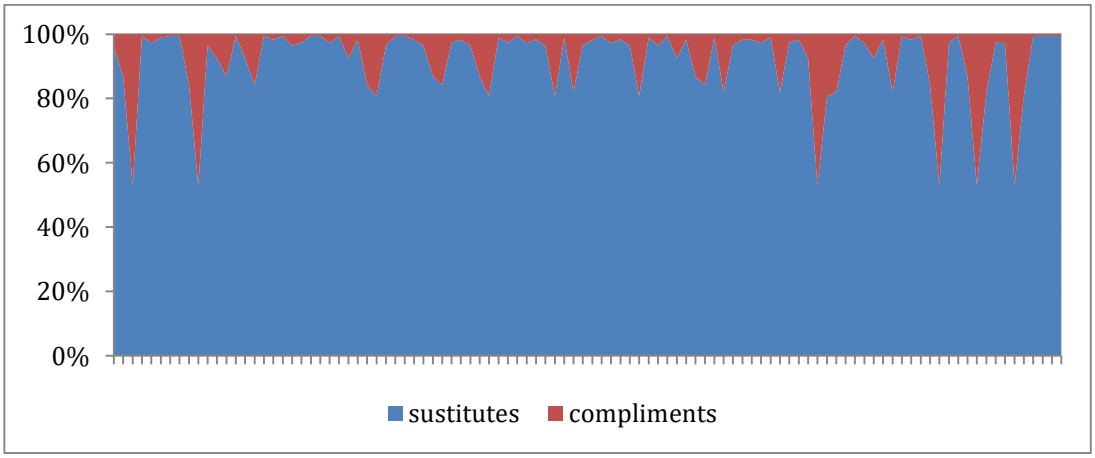

Figure 1: Relationship between brick compliments and substitutes.

Brick price: it is price of one brick.

Transport cost: The cost of tractor trolley that brings bricks etc, at construction house site has to be paid by owner/builder of the house.

It includes transport cost of orders of bricks, all items of cement mix, wood, ceramic, blocks etc.

Annual income: it is income of the owner of house. Average income of the house owner is 20 lakh rupees per annum.

Taste: This variable is calculated based on the use of quality bricks in the construction of house. There are two types of bricks normal / ordinary and Bhelli bricks. Normal bricks include Qisti, Roof, NavSha and Dhero. There are no any Bhelli bricks in these denominations which are required for the house construction. Bhelli bricks which are used are actually from Qisti form.

Taste determines saving. If more second quality bricks are used it means more saving. Saving means cut in overall cost. On the average 0.79 part bricks are good quality used in house. It means0.21 part is bhelli in house. So the higher cost is (79-21= 58%). Cost of bricks increased per order because there are 58% more orders of the good bricks on average. This is cost of taste.

Bhelli brick is 58% underused. So taste costs 23 lakh rupees more , on the average, for a house. Cost of good brick order is 36k while that of bhelli is 12k. It is twice the saving per order.

Bigger the house higher will be taste cost.

Future Price:It is saved amount of cost of bricks due to buying in bulk. If bought in bulk owner can save cost , on average , at the rate of 1000Rs/order for BhelliQisti bricks, 1500Rs for Qisti normal, 2000Rs for Roof, 2100Rs for Dhelo bricks.

Technology: It is cost of motor installation, map cost and cost of tools rented.

Weather cost: It includes costs due to rain loss, storm loss and labour sickness loss.

Table10
Model summary SPSS

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	1.000[a]	.999	.999	.02345

a. Predictors: (Constant), consumerNumb, futurecost, waethe, brickprice, pr2, technology, labour, income, pr1, transport, taste

Table11
ANOVA of the model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	54.629	11	4.966	9029.893	.000[b]
	Residual	.048	88	.001		
	Total	54.677	99			

a. Dependent Variable: brickused

b. Predictors: (Constant), consumerNumb, futurecost, waethe, brickprice, pr2, technology, labour, income, pr1, transport, taste

Table12
Model coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.031	.186		-.166	.869

Brickprice	-1.104	.039	-.253	-28.188	.000
Income	.121	.007	.124	17.117	.000
pr1	.218	.014	.316	16.011	.000
pr2	-.077	.004	-.100	-18.351	.000
Taste	.626	.022	.497	28.279	.000
Futurecost	.125	.025	.125	4.985	.000
Waethe	-.056	.015	-.019	-3.714	.000
Transport	.232	.018	.219	12.786	.000
Technology	-.030	.016	-.012	-1.961	.053
Labour	-.074	.007	-.057	-10.878	.000
consumerNumb	-.132	.007	-.093	-18.728	.000

a. Dependent Variable: brickused

Demand Equation generated is

$\ln Q = -.031 - 0.253\ln P + 0.124\ln M + 0.316\ln P_{r1} - 0.100\ln P_{r2} + 0.497\ln T_{+}\ 0.125\ln P_{e} - .019\ln W + .219\ln Tr - 0.012\ln T_{ech} - 0.057\ln L - .093\ln N$

R square is .99

Significance: all costs are significant except for technology cost

Negative relations: Variables brick price, Price of related goods 2, labour, weather, technology and consumer number have negative relation with Y variable.

Pr 2 is compliment. It includes sum of costs of blocks, stones, wood and ceramics.

Pr 1 is substitute. It includes sum of costs of following construction materials. Cement, steel,krash, sand,Bolari,Roro and poder,

House is normal good as income coefficient is positive.

Conclusion

North Sindh houses were surveyed that have been built recently i.e. within two years. Participants who took part in this survey were 62, 22 and 16 from khairpur, sukkur and larkana respectively. All the participants were Muslim male. Their average age is 39 years. Most of them lied in the age bracket of 31-40 years age. Most of the participants are intermediate pass. Only 28% of the participants have any earlier experience of constructing a house. only 19 of the participants has got any training of house building. all the houses surveyed used bricks as main walling material. All houses preferred burnt bricks to unbaked / raw bricks. All are *Pakka*houses. It took them to built house within 0.5-3 years. Actual days work is less than total days. 48 % participants have rural houses. mostly houses are TG based (60%), RCC (Reinforced Cement Concrete)consists of 24 % houses only. RCC used by 25 % of rural houses. TG (tier grider) houses are mostly found in rural areas. All the small houses are TG houses. 22 participants have not taken loan for house construction. 60 participants have taken between 1-10 lakhs.

All the houses surveyed are further classified into three categories i.e. Small, Medium and Large houses.This classification is scholar's own classification to facilitate calculation of gini coefficient and Lorenz curve. There were 28 small, 50 medium and 22 large houses in the sample. Average Area is 1972, 2811 and 3754 square feet for small, medium and large houses. There are 2, 3 and 5 rooms in small, medium and large houses. There are 1.1, 1.5 and 1.8 storeys at small, medium and large houses. 40 % of the participants have 2 storey houses with average of 3.3 rooms. 60 % of the participants have 1 storey houses with average of 2.7 rooms. When asked to sale house the price they said was in range of 4 – 7 Million, 5-7.7Million and 6-9 Million Rs for small , medium, and large houses.

House can be built by self of contractor. 68% of the participants have not employed a contractor. Compliments of brick (Pr 2) include sum of costs of 4 construction materials i.e. blocks, stones, wood and ceramics. All are not used at a time

in one house. Blocks are not used in North Sindh in house construction. Substitutes of brick (Pr 1) includes sum of costs of seven construction materials i.e Cement, steel, *krash* , sand,*Bolari, Roro and poder.* All are not used at a time in one house. Most of the house builders/ participants (99%) bought bricks in bulk to save brick cost. There is no any preference of any specific brand of bricks. Bricks are treated as generic product. Only better / superior quality bricks are preferred. The cost of tractor trolley that brings bricks etc, at construction house site has to be paid by owner/builder of the house. Average income of the house owner is 20 lakh rupees per annum.

Taste variable is calculated based on the use of quality bricks in the construction of house. There are two types of bricks normal / ordinary and Bhelli bricks. Normal bricks include Qisti, Roof, NavSha and Dhero. There are no any Bhelli bricks in these denominations which are required for the house construction. Bhelli bricks which are used are actually from Qistiform.Taste determines saving. If more second quality bricks are used it means more saving. Saving means cut in overall cost. On the average 0.79 part bricks are good quality used in house. It means0.21 part is bhelli in house. So the higher cost is (79-21= 58%). Cost of bricks increased per order because there are 58% more orders of the good bricks on average. This is cost of taste. Bhelli brick is 58% underused. So taste costs 23 lakh rupees more , on the average, for a house. Cost of good brick order is 36k while that of bhelli is 12k. It is twice the saving per order.Bigger the house higher will be taste cost.

Future Price is saved amount of cost of bricks due to buying in bulk. If bought in bulk owner can save cost , on average , at the rate of 1000Rs/order for BhelliQisti bricks, 1500Rs for Qisti normal, 2000 Rs for Roof, 2100Rs for Dhelo bricks. Technology cost is cost of motor installation, map cost and cost of tools rented. Weather cost includes costs due to rain loss, storm loss and labour sickness loss.

House is built by 15, 21 and 25 labourers (including owner, and contractor if there is) total for small, medium and large houses. On the average there are 5, 8 and 12 labourers working at a house. The labour that works at a house is of different types. There are four types of Mistri, and 7 types of labour at house being constructed. Mistris are Osariwara, Palasterwara, Shatringwara and Iron fitter. Labourers are cement mix maker, brick carriers, osari helper, iron binder helper, palaster helper, staring helper and digger. Mazddors get higher income in times of Wheat Harvesting , Sugarcane and cotton seasons because there is shortage of construction labour. their demand increases. Mazddors are in ratio to Mistris 1: 2. Some Mazdoors who are hired on contract they pay commission Rs 50 (formazoodr) and 100Rs (for Mistri) on daily basis to contractor. There is no any labour union in North Sindh for construction labour.If the meal is on the house the daily income is reduced by usually 100-200 rupees.

On average it takes 2 to 3 months to construct a single storey house on 1000 feet square with 4 rooms 33*30.6 feet using 15000 Qisti bricks (or 5000 Dhero bricks or 10000 Navsha bricks) and 1000 roof bricks (if tier grider used) and on average 10-15 labour force, using 200 cement bags, 1000kg steel (or 12 grider of 120 kg each) , 2 black sand trolleys, 2 krash trolleys, 1 Bolari (Red sand), 1 Roro trolley, 1 poder trolley. All trolleys measure 4 seckro. (1 sekro measures 1000 kg.) Bhelli bricks used are 1 in 3. It includes doors, windows, rented tools, tiles, ceramics, electricity fitting etc.

Masalo (Mix) is part of cement mix.It is used to fill the dig, ceiling and used between bricks in Osari. There are three types of Masalo (Mix) used different because of unique ratio of black sand , Bolari/krash and cement. Osarmasalo includes 2 small trolleys sand, 1 bolari, 1Poderand 1 bag cement. Filling masaloincludes 3 small trolleys sand, 3 krash and 2 bags cement. Palastermasalo includes 1 small trolley sand, 1 bolari and 1 bag cement. Note that 2.5 bags of cement fill small trolley (wheelbarrow). Note that krash and cement never mix so sand added. Krash is necessary for filling ceiling columns, and dig. For 7*7 wall osari such Osarimasalo will be required three times (500 bricks). But for Dhelo (150 bricks used in 7*7 wall) it will be sufficient once.RCC (Reinforced

Cement Concrete) ceiling is filled 6 inch thick. Such above filling masalo is sufficient for 9*9 feet area of ceiling. It is 18 feet masalo plus cement.

It takes 3 to 4 months for double storey same house with everything double.

On average 1000 feet square house costs including everything 1000*5000= 5000000 Rupees.

Contract rates for 1000 feets square house are 200 Rs per foot (tier grider) or 300 Rs per foot (RCC). RCC construction is costly. In 2021 it was 150 Rs and 250 Rs respectively. Final roof / ceiling which is finished is measured to find total feet for rate applying or calculation of house cost.

On average an OsariMistri construct 7*7 wall in a day. Wall is 7 feet tall and 7 feet long. Its width is 4 inches. 3 Qist bricks laid on above other in 1 foot. 3*7=21. Total bricks used in 7*7 wall are 21*21= 440. (7*21=147 Dhelo) (14*21= 294 NavSha). Roof bricks for 7*7 ceiling are 14*7=98. In RCC house OsariMistri and ShatingMistri work side by side. Sometimes parallel and sometimes in sequence, but mostly in sequence i.e. when one works other stops. There is no heavy work for Shatingmistri in Tier Griderhouse , it usually lasts 15 days for ideal 1000 feet square. OsarimIstri is high in demand for Tier Grider House.

Iron Fitter /Binder Mistri is in high demand for RCC house unlike at Tier Grider house. PalasterMistri works when Osari and ShatingMistris complete their work. There are certain tools accompanied to each Mistri type. Mistris prefer Theeko (contract) not daily wages. Labour get paid even if work at mosque. Mistri don't prefer to work with blocks as it is difficult work as compared to work with bricks. Blocks are not used in North Sindh as there is hot climate. Blocks rupture/ burst in heat.

Average wage is 500 daily for contractor, 450 for average labour and 1100 for Mistri. Overall average is 500-700 rupees for all labour special as well as ordinary. There is no any female working at house construction sites at least according scholar's data collection and observation. So male female ratio, gender wage gap and Duncan Index could not be calculated. Mode of payment is that contractor gets in advance. Ordinary gets paid at the end of day via Mistri who distributes to them and self. Sometimes contractor also gets a small percentage of that wage of ordinary labour for himself. Sometimes contractor is Mistri himself. There are three facilities provided to labourie., Food and water on site, Travel allowance, Injury insurance. Working time for construction labour is between 7 or 8 am to 5to 6 pm, on average 9 to 11 hours including 1 to 2 hours lunch/rest time.

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