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Current agricultural mechanization practices and attractive attributes towards its modernization for food security in belt and road countries: Pakistan as a case study

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Abstract
The unceasing accumulation in nutrition consumers is an indicator of the cumulative demand for food in approaching days, while the measure of starving, hungry and malnourished people is increasing again especially in developing countries. Food security in Pakistan is leading contest of the present-day, due to uplift resident's growth, prompt urbanization, substandard purchasing potency, eminent price uncertainties, inconsistent food production, and incompetent food distribution arrangements. Agriculture is a fundamental source of nourishment and play a vital role in the development of the local economic system and act as a shield for food security in many countries affiliated with one belt one road initiative.
The operational agriculture segment of Pakistan is less than in assessment with its potential in the present age because it has been challenging several key contests but we are only considering the lethargic rate of technological transformation. Agricultural automation is wide-ranging foundation confined on distribution and application of several tools, apparatus and technology and transposition of human and animal power for distinct agricultural applies. Application of modern-day types of machinery in agriculture has significant considering for food security, while agriculture producers of developing countries are fronting the absence of financial elementary inputs and they desire inexpensive, reasonable and appropriate technologies and applies for supportable agriculture production to accomplish the ultimate goal of food secure world. Belt and Road Initiatives could be facilitator for the guarantee of sufficient food availability in future by supporting and developing the low level existing agricultural mechanization technology in developing countries.

Keywords: food security, agriculture, agricultural mechanization, modernization, belt and road countries

Introduction
The Food security fabricates on the succeeding four proportions, healthy food availability, convenience approach to food, effective consumption, and stability of previously discussed food components although, availability and accessibility have precious status in the oath of food security in all over the world [1]. Continuously addition in food consumers is an indicator for cumulative demand of food in coming days [2, 3], while the quantity of starving, hungry and malnourished people are growing again especially in developing countries [4], because population growth rate is higher, only local food production system is way of getting nutrients necessities and less purchasing supremacy of expensive imported food. In the developing region, to accomplish the nutrition necessities of mounting population desires, that will be increased 70 to 100 % in 2050 [5], a sustainable food production system is required.
Pakistan comprises approximately 199.71 million nutrients consumers of the world while, population fertility and growth rate are 3.0 and 1.86 respectively, a sign of growing the number of food users in coming days [6]. Food security in Pakistan is the dominant challenge of the present age, due to elevating inhabitants' growth, expeditious urbanization, inferior purchasing potency, eminent price instabilities, inconsistent food production, and incompetent food distribution arrangements [7].
Being an agrarian country, agriculture is the foremost implementer for national growth, poverty reduction and food security, subsidizes 19.5% shares in GDP, a foundation of 42.3% labour force revenue, establishes 65% of export income and responsible for livelihoods to 62% of the inhabitants of Pakistan [8]. The functioning of the agriculture sector of Pakistan is less than in assessment with its potential in present age, because it has been confronting several key challenges like sluggish rate of technical modernization, participation supply difficulties, insufficient extension amenities, inadequate investment, publicizing and trade limitations, and inadequate quantities of credit for agrarian production and processing, during the last decade [7]. According to Pakistan Economic Survey 2016-17, the agricultural growth rate is declining uninterruptedly during the past few years. It is essential to the emphasis on agricultural production due to its knowing contribution in nutritious food security [9].
Agricultural mechanization is comprehensive premise contained on distribution and application of various tools, equipment and technology and transposition of human and

animals power for distinct agricultural practices [10]. The current discussion on agricultural mechanization substitutes into the upgrading of existing agricultural technologies along with global sustainability of agricultural production system [11]. The indications attained from preceding research recommended that mechanization has significant encouragement in the reduction of farm labour and sustainable agricultural productivity [12], and application of contemporary technologies in agriculture is a key for food security [13]. Previous research on enhancement of agriculture production indicates that the application of contemporary technologies and practices can rise the food production but still, some queries are in existence like; how many agrarian producers have easy access to these technologies and knowledge, how many have enough resources to purchase it? Agriculture producers of developing regions are facing the deficiency of economic base inputs and they need cheap, affordable and suitable technologies and practices for sustainable agriculture production to achieve the ultimate goal of food secure world [14, 15].

Belt and Road basically is the revitalization of the antique silk road, which was comprised on various trade routes and mutual cultural exchange, among the people of Eurasia. It was responsible for peace, cooperation, openness, inclusiveness, mutual learning and mutual benefits of the individuals of this area. The modern china 's silk road is a facilitator for trade, development, infrastructure and cooperation among the 64% population and accounts for 30% GDP of the world [16]. The effectuation of China's silk road regulates agriculture and other elements like education, technology, economy, politics, tourism, infrastructure and industry. Agriculture is a fundamental source of nourishment and play a vital role in the development of the local economic system and act as a shield for food security in many countries affiliated with one belt one road.

Food security state in belt and road countries

The world is under the experience of following present age challenges of swift growing population, levitation poverty specifically in developing countries and unbalanced environmental conditions, these encounters are the supportive pillars for food insecurity, low economic development, political disturbance and insecure environment for human beings on this planet [17, 18]. A country considered a food secure if all the citizens have physical, communal and commercial access to appropriate, secure and wholesome food for energetic and vigorous life throughout by means of self-contained [19]. According to FAO, food security and world malnutrition are multi-dimensional comprehensive issues of the present age, due to the stable augmentation in the percentage of nutrients consumers on this plant and anticipated to grasp 9 billion individuals by 2050 [20]. Regardless of all the cooperative efforts, the figure of malnourished and hungry individuals in the world is increasing yet again (shown in fig.1) and the prospect of eliminating malnutrition by 2050 and financial stability become uncertain [4, 21] because 70% to 100 % additional food quantity will be required hereinafter [22].

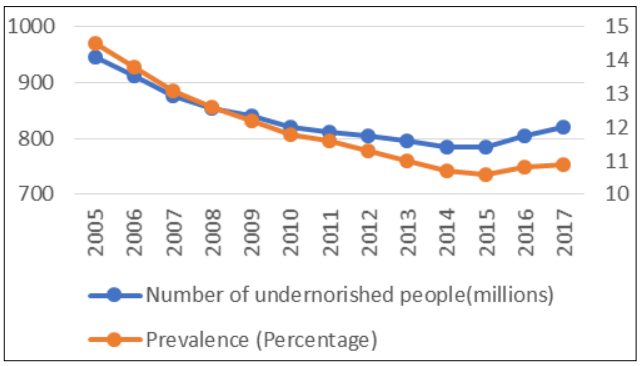


Fig 1: Number of undernourished people & food security prevalence

The food uncertainty is overriding conundrum specifically in developing world due to the subsequent reasons; unremitting accumulation in food consumers, wicked poverty conditions, natural calamities, armed conflicts, political instability, and unsustainable agricultural production [21–23]. The accessibility of sufficient essential nutrients in most of belt and road countries is not in satisfaction condition, Asian region is continuously accumulating undernourished people and get the highest figure while the prevalence of undernourishment in African region is significantly at highest position in the world [21, 24] and more than 800 million inhabitants of these two sections suffering undernourishment.

The South Asian segment of belt and road countries is under the conundrum of the acute densely populated area on the globe, additionally contained 3.99 million estimated inhabitants living under the extremely poor standard of USD 1.25/day [25]. The agriculture sector is accountable for providing elementary food supplies along with 50 % inhabitants of this segment of the world be contingent on it. The South Asian country, Pakistan contains around about 199.71 million nutrients consumers of the world while, population fertility and growth rates are 3.0 and 1.86 respectively, a sign of growing the number of food users in coming days [6]. Food security in Pakistan is leading challenge of the present age, due to elevating inhabitants' growth, expeditious urbanization, inferior purchasing potency, eminent price instabilities, inconsistent food production, and incompetent food distribution arrangements [7]. Regardless of all the attempts, food security condition is on frightening stage in Pakistan [26], According to the Food Security Assessment Survey (FSA), 2016, Pakistan contains 18% of undernourished, severe stunting (45%), wasting (15%) and underweight (30%) inhabitants over its entire population. The undernourishment complications are high in rural areas (46%) and in particular areas like FATA (58%), Northern areas (51%) and Baluchistan (52%) Correspondingly, around 50% of the residents are captivating less than the essential nutritional requirement of Vitamin-A and iron. [27].

Status of Agriculture sector in Pakistan

Being an agricultural country, agriculture is the prime implementer for national development, poverty reduction and

food security, sponsors 19.5% shares in GDP, a foundation of 42.3% labor force revenue, establishes 65% of export income, 70 % of Pakistani economy, and accountable for livelihoods to 62% of the residents of Pakistan [8,18]. Pakistan is the 4th largest cotton and 9th largest wheat producing country in the world. Agriculture sector occupied the chief position in sustainable development, reduction of underfeeding, diminishing the environmental influence to sustain human life standard and also responsible of rural employment, the source of energy, raw substantial for agricultural and non-agricultural industries [27, 28].

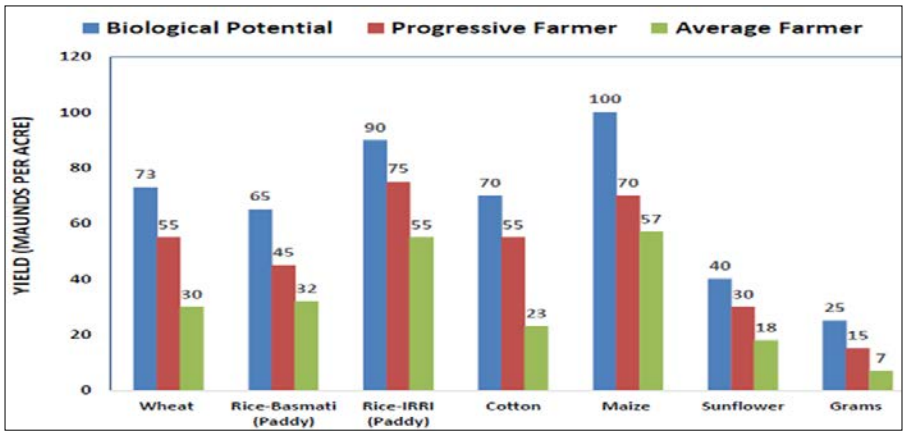
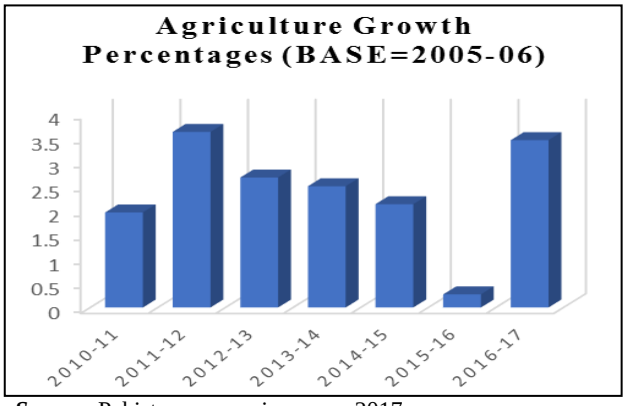


Fig 2: Agriculture potential yield in comparison with yield of progressive and average farmers

At very initial phase subsequently the attendance of Pakistan on the map of world, agriculture sector was considered the principal source of GDP of country and had the shares of 53% in 1950, unfortunately over the period of 1950 to 2017 the shares of the agricultural sector in GDP were continuously decreasing, in 2017 the contribution of the agriculture sector was 19.5 %, the same decreasing trend was observed in agriculture employment sector [8, 29]. The performance of the agriculture sector is not pleased in accordance with the prevailing potential over the last few years.



Source: Pakistan economic survey 2017

Fig 3: Agriculture growth percentage of Pakistan

The yield percentage of agriculture sector is also under the pressure of low productivity, it is experiential that the yields of sugarcane, wheat and cotton, non-basmati rice and milk are lower than the global benchmark as 40%,20 %, 40 % and 90 % respectively [30, 31]. Sustainable agricultural production principally be subject to the working efficiency of existing agricultural practices and efficient use of appropriate utilization of mechanized technology is responsible of efficiency of agricultural inputs [32].

Mechanized agriculture as an art of food security facilitator

Agricultural sector always fascinated the scientists and strategy fabricators towards itself for the resolution of the sustainable food supply. The green revolution started in the 1940s for the purpose of providing the sufficient and healthy food for the inhabitants of Maxi coat. After the successful application of the hybrid variety of wheat with the combination of agricultural mechanization technologies, The United States was shifted wheat importer country to wheat exporter country in the 1960s [33, 34]. The efficient utilization of accessible agricultural resources is the declaration of augmentation in sustainable agricultural production, and an important foundation to improve the food availability and ultimate a substantial contribution towards food security [35]. The world is motivated towards sustainable agriculture production considering it as a supreme facilitator for food security in the developing the region. There is an expressive tendency of urbanization particularly in developing countries. The urban agriculture has great influence on urban food security and earning source of 40% urban inhabitants of African countries and while on another hand 50% of residents of Latin American countries which are directly or indirectly associated with agriculture, therefore urban agriculture has its own distinct place in addressing the food security and poverty issues in both developing and developed regions [36].

The small farm contains 90% of globally existed farms and responsible for 80% world's food production, despite the higher productivity of small farmers in accordance with the large farmers, food insecurity is still prominent issue existed in this zone [35]. Modernization in agrarian production system has a significant influence on the availability of adequate and vigorous food, and also responsible for sustainable food supplies in Pakistan. Food facilitator system is fronting succeeding problems: 1) impoverished and leisurely source of agricultural participation along with quality, quantity and high

charges issues.2) deficiency of suitable infrastructure and types of machinery for value addition, and promotional infrastructure necessities and trade possessions of agricultural products.3) inappropriate utility of naturally existing resources and extremely immoral climate change influences on production system of agriculture [27].

Agricultural mechanization has become a multi-dimensional concept of the present age, includes economic and ergonomics application of engineering knowledge for manufacturing and utilizing of different agricultural types of equipment for different agricultural practices and globally aim of sustainable agricultural production [37]. Mechanization has its exceptional standing among all farming inputs due to its prevalent following operative characteristics; 1) Augmentation in the efficiency and output of farming operations by decreasing input, 2) has the dimensions of increasing cultivated are from available cultivated waste, 3) as a defense for farmer from unpleasant environmental working circumstances and ergonomic problems 4) multifunctional features of some agricultural equipment are accomplished of doing dissimilar responsibilities [38, 39]. Attractive attributes of agricultural mechanization are: deliverance of seed quantity and quality, redemptive 15% to 20% fertilizer, economize 20% to 30% time and labour, elevate 5 % to 20% crop intensity and 10% to 15 % productivity [40]. Increasing requisition of up-to-date technologies in agrarian sector of developing regions with declining agrarian labour is the consequence of sustainable agricultural production which is the significant source of nourishing the people of this world [37, 41]. The agricultural sector of Pakistan is under the experience of low productivity growth since last few years [9] is the derivation of overall food insecurity and poverty in Pakistan. The key obliges in sustainable agricultural production in Pakistan is non-availability of appropriate agriculture machinery at the specific period at a reasonable price, to overcome on these issues there is need of innovation in agricultural mechanization sector [42].

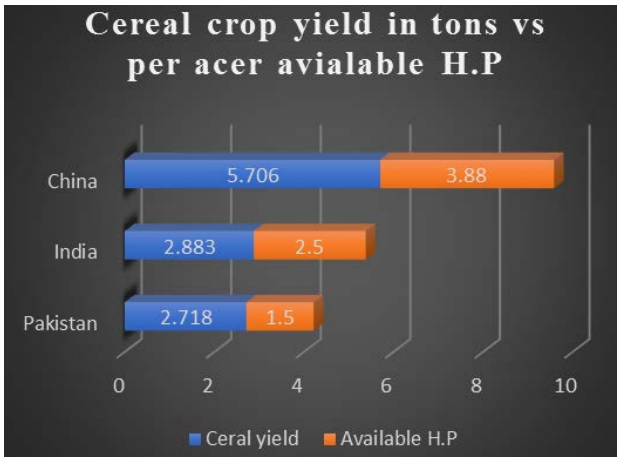


Fig 4: Comparison of Cereal crop yield in tones vs per acer available H.P

Current agricultural mechanization practices in Pakistan

Tractor with the population of 948 thousand in 2014 and average available hours power of 50 per unit [6], is the mainstay of agricultural mechanization sector of Pakistan along with other contributes, biotic farm power, and trivial diesel engine and electric motor [43], the percentage of different farm power sources available in country are displayed in fig.2. Punjab is the leading province in term of tractor utilization in the agriculture sector and acquires 80 % shares of entire tractor population in Pakistan [44]. Based on the quantity of available agricultural tractors in counter with the total agricultural area of Pakistan, the calculated horsepower is 0.84 HP/acre while according to FAO the minimum required horsepower is 1 HP/ac [6, 45]. The agriculturalists of Pakistan are still dependent on conservative agricultural mechanization applies, following pieces of equipment; cultivator, MB plough, disc plough, disc harrow, chisel plough and rotavator are typically used for different ploughing purposes. The absolute number of these conventional types of equipment is increasing [46] due to fewer draft requirements while in result the excessive use of this old fashion machinery for land development is a time-consuming process is one of a major cause of low productivity [47, 48].

Table 1: Different sources of farm power available in Pakistan

Power Source	Average HP capacity	Population	Available HP
Tractors	50	948,919	47445950
Work animals	0.5	200000	100000
Human labour	0.1	38.1*10	3.86*10
Tubewells	16.75	1075073	18007473

The optimal plant population, proper depth of seeds and seedlings, appropriate row to row and plant to plant distances and overall early crop establishment in the filed depend upon the usage of suitable agricultural machinery for sowing and planting purpose [49]. Wheat is one of the main crops of Pakistan while the application of modern mechanization for sowing still not achieved, locally available seed drills are seed cum fertilizer drill, coulters drills and disc tiller drills [50], while conventional method of sowing (broadcasting) is practiced in some areas due to the lack of agricultural machinery, [51]. Application of broadcasting unable to control and count the population of plants in the field is also a major reason for low agricultural yield in Punjab province [43]. To preserve the plant to plant distances during the plantation of several row crops different multi-crops transplanter are used [46], while the exercise of manual planting for maize and cotton especially in Punjab has still existed. The cotton growers are moving semi-mechanized drilling of cotton to fully manual planting practice due to severe environmental conditions which are not favorable for drilling of cotton. The transplantation of rice seedlings in Pakistan is mostly done by hand, before one decade the status of self-propelled rice transplanter was zero recently, some companies from China and Korea are trying to marketing their products in rice grower zone of Pakistan [52].

The agro-chemicals application efficiency reported in Pakistan was 50% [53] due to only availability of poor quality plant protection machinery because efficiency is a direct function of mechanized source of spray [54]. Knapsack sprayers (human driven and engine driven) are very accustomed among low income and small farmers for the application agro-chemical to control weeds as well as pests, while application of locally manufactured tractor mounted sprayers despite having non-

uniformity in application pattern, is limited to high income progressive farmers due to high capital investment [55].Mechanical elimination of weeds from various row crops is also considered a dependable source among the small and large farmers [43] and the extermination of weeds is done by both manually as well as by the application appropriate intracultural equipments like bar harrow and tiny cultivator [48].

Table 2: Prices and production of locally manufactured tractors 2016-17 (July-March)

Tractors Model-Horse Power (HP)	Price/Unit Including GST (Rs)	Actual Sale (in Nos.)
M/s Al-Ghazi Tractors		
NH 480-S (55 HP)	718,200	4,116
NH 480-S-W.P (55 HP)	724,000	1,720
NH-Ghazi (65 HP)	813,750	5,331
NH-Ghazi WDB (65HP)	821,100	362
NH -640 (75 HP)	1,033,200	1,669
NH -640 WDB (75 HP)	1,039,500	131
NH -640-S (85 HP)	1,078,350	77
NH -640-SWDB (85 HP)	1,093,050	28
NH-70-56 (85 HP)	1,617,000	5
Dabung – (85-HP)	1,617,000	487
M/s Millat Tractors		
MF-240 (50 HP)	716,625	8,697
MF-350 Plus (50 HP)	734475	33
MF-260 (60 HP)	821415	5894
MF-360 (60 HP)	838425	458
MF-375-S (75 HP)	1065225	1808
MF-385 (85 HP)	1126860	6951
MF-385 4WD (85 HP)	1694175	318
Grand Total		38085

Manual power is the leading source of harvesting cereal crops, cash crops, fodders, vegetables and fruits in Pakistan. Harvesting progression of wheat implemented by farmers can be categorized into proceeding three sub divisions of cutting, collecting and threshing. On the base of these subdivisions three different harvesting schemes existed in

Table 3: Growth of different tillage implements during the last four decades (GOP, 2015)

Years	Cultivator	MB Plough	Disc Plough	Disc Harrow	Chise Plough	Rotavator
1984	146863	7319	6355	8140	712	2101
1994	236272	28413	20372	12233	6535	5594
2004	369866	40050	29218	23764	8514	47919
2014	901473	189784	142338	94892	47446	113870

harvesting process among the wheat growers of Pakistan are; 1) manual cutting + manual collecting + mechanized threshing, 2) mechanized cutting (tractor mounting reaper) + manual collecting + mechanized threshing, 3) fully mechanized harvesting (combine harvester) [56], for rice harvesting schemes are 1) manual cutting + manual collecting + manual threshing, 2) fully mechanized harvesting (rice harvester/modified wheat harvester). Available stationary threshing machines in native market driven by tractor PTO proficient of high throughput while on other side having boundaries of high weight and cost, energy ineffective and hazardous working environmental conditions [57].

Attractive attributes towards modernization of mechanization in Pakistan

Human labor as foremost power source: The application of biological farm power is overriding influence in developing region and has 80% its contribution in overall available farm power and also accountable for 50% cultivated area of the world, while on other hand mechanized power is prominent source in developed countries [58][59].Effusively motorized farming equipments have the features of high investment cost whereas most of the famers of Pakistan are small farmers and don't have sufficient capitals to purchase the high prices agricultural machinery. Administration of Pakistan is trying to facilitate the agricultural grower in terms of fertilizer and electricity subsidy while there is absence of effective agricultural mechanization policies.

Increasing trend in urbanization: The glamourous urban life pattern due to its appealingness services attributes of contemporary transportation availability, occurrence of satisfying health and care prospects, potential education system along with higher income opportunities, while in contrast conventional rural life pattern due to lack of indispensable services of transportation, health and education along with arduous agricultural tasks, punitive and unhealthy working environmental conditions in fields with low earnings are the major reasons of urbanization globally. According to [18] the collective share urban inhabitants was 46% in 2012 while it is indication of researchers this segment will accumulate to 50% in Asia and its pacific regions in 2020. Working efficiency of farming labour force is low as

compared with nonagricultural sectors and the incomes of industrial and services employs is 6 times more than agriculture labors [60].

Unproductive application of mechanized practices: Improper and habitual usage of a specific agricultural machinery participations (tractor) in many developing countries like Pakistan leads toward stumpy farming production, dilapidation of fertility of soil, substantial economical fatalities and also has a well-known environmental degradation [58]. Inappropriate usage of cultivation machinery is a compound of changing soil properties and distressed the movement, infiltration and evaporation of water as well as effected the root growth in the soil [61], repetition of this practice among growers of Pakistan is also a factor of low wheat production [62]. Due to pathetic acquiring of agricultural machinery farmers are forced to use the old-fashioned harvesting machinery and it is estimated that percentage of harvesting losses for wheat and rice is 10% to 15% due to overdue in harvesting process and custom of unbefitting harvesting machinery.

Limitation application of mechanization and technology: At present, the application zone of agricultural mechanization is restricted to just farming, in result not as much of attraction towards development and application of value addition technology in agriculture products at farm level [63].The agricultural mechanization sector of Pakistan is fronting lack of application of scientific knowledge which is also chief origin of low crop yield and Pakistan's agriculture production system has capacity to produce 50 to 83% lower yield in comparison of average yield of other countries who are bearing in mind the application of contemporary technology in agricultural sector [43]. Value added machinery and implements perform exceptional role in the reduction of post-harvest losses specifically in horticultural farming sector therefore developed countries are concentrating on this sector, while unfortunately in Pakistan it fails to attract the intention of manufactures.

Lack of quality standards in local machinery production: Agriculture machinery creation sector of Pakistan is contained near about 500 minor and intermediate manufacturing units, are manufacturing specific agricultural equipments for specific different agricultural practices. Locally manufacturing units are not able to produce world class standards equipments due to less facilitate manufacturing units, unavailability of proper management, improper manufacturing and design techniques, lack of skilled and technical labor, locally

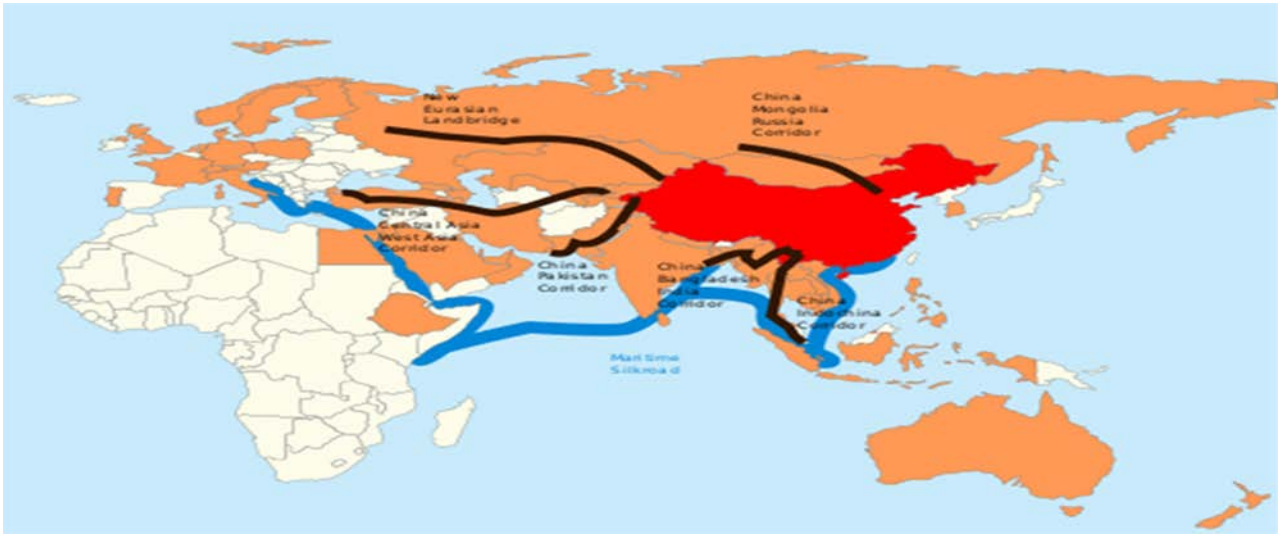


Fig 5: Over view of Belt and Road Initiatives

Low quality available raw material, shortage of financial and marketing qualities, and unawareness about international manufacturing standards and unavailability of international standard in local language [43].

Unskilled operating and maintenance labor: Mechanized agricultural labor has deficiency of effective operational and maintenance cognition, derivation for injurious operational atmosphere for labor, curtail application effectiveness of agriculture equipment, fruitless mechanization output, and ultimately exaggerate overall farming cost [63].Locally accessible workshops which are less furnished with maintenance apparatuses and technologies, and unqualified maintenance labor force are the main roots of underprivileged quality maintenance services for agricultural equipments [43].

Availability of culturable waste land: According to Pakistan Bureau of Statistics, Pakistan comprises 8.27 million hectares culturable waste land and 22.77 million hectares total cultivated area which are about 10.30% and 27.72 % of entire topographical area (79.61million hectares) respectively, culturable waste is available for crop production but due to inadequate possessions of modish agricultural practices and technology it is not under consideration [64].

Raising water security issue: Agriculture is the second chief consumer of groundwater and stocks 43% of entire extracted groundwater for irrigation, and over a three quarters of world freshwater [65], while mounting population is a symbol of supplementary irrigation water requirements for sustainable agricultural production in future [66].

Belt and road initiatives

The five imperative attributes of Belt & Road initiatives are; policy coordination, Infrastructure connectivity, assistance of

trade and investment, financial cooperation and people coordination among the people of belt and road countries [67].China-Pakistan economic corridor has its irreplaceable proportion in preliminary mission of the Belt and Road Initiatives and it is known as joint cooperation in energy, transportation, infrastructure and industrial sectors for mutual reimbursements not only for these two countries but also has a unique importance for other countries of this area.

The definitive objectives of CPEC for china are the advancement in economic and social improvement in its western region, acceleration in implementation of Belt and Road Initiatives, creation of opportunities for development of technology and engineering enterprises and formation of new economic system while, on Pakistan side are enhancement in industrial capacity by creating new industrial zones, stability in socioeconomic conditions, improved livelihood and promotion of domestic and regional peace and stability. During last few years, China and Pakistan have executed astonishing improvement in commercial cooperation, improvement people's livelihood and social development with the average annual growth rate of 18.8% [68]. The strategic cooperation areas of CEPC are construction and integration of transportation system along with information and network infrastructure for global connectivity, cooperation in energy related fields for sustainable power production, promotion of industrial and trade sector for global marketing and financial cooperation for effective development in agriculture for poverty reduction and food safety of the world.

Conclusions

The continuous gathering in nutrition consumers is an indicator of the cumulative demand for food in approaching days, while the quantity malnourished people is increasing again especially in Belt and Road countries. Agriculture is a important source of nutrition and play a vital role in the development of the local economic system and act as a shield for food security in many countries affiliated with one belt one road initiative. Application of modern-day types of machinery in agriculture has significant considering for food security, while agriculture producers of developing countries are fronting the absence of financial elementary inputs and they desire inexpensive, reasonable and appropriate technologies and applies for supportable agriculture production to accomplish the ultimate goal of food secure world. Belt and Road Initiatives could be facilitator for the guarantee of sufficient food availability in future by supporting and developing the low level existing agricultural mechanization technology in developing countries.

References

1. Akbar M, Economics/Zemedelska AJA. Undefined Impact of macroeconomic policies on national food security in Pakistan: simulation analyses under a simultaneous equations framework, 2017. agriculturejournals.cz n.d.
2. Godfray H, Beddington J, Crute ILH. Undefined Food security: the challenge of feeding 9 billion people, 2010. science.sciencemag.org n.d.
3. Hafezalkotob A, Hami-Dindar A, Rabie N, Hafezalkotob A. A decision support system for agricultural machines and equipment selection: A case study on olive harvester machines. Computers and Electronics in Agriculture. 2018; 148:207-216 10.1016/j.compag.2018.03.012.
4. Prosekov A, Geoforum SI. Undefined Food security: The challenge of the present, 2018. Elsevier n.d.
5. Baulcombe D, Crute I, Davies B, Dunwell J, Gale M. Reaping the benefits: science and the sustainable intensification of global agriculture, 2009.
6. Government of Pakistan (GOP) Economic survey of Pakistan 2014-2015. Finance Division, Economic Advisor's Wing, Islamabad, 2015.
7. Agriculture MOF. National food security Policy For Timor-Leste. 2005.
8. Fishing T, Pakhtunkhwa K. Chapter 02. 2016; 19-40.
9. Governt of Pakistan. Pakistan Economic Survey 2016-17, 2017.
10. Akinbamowo RO. A review of government policy on agricultural mechanisation in Nigeria. Journal of Agricultural Extension and Rural Development. 2013; 5(8):146-153. 10.5897/JAERD2013.0450.
11. Mrema G, Soni P, Rosa R. A Regional Strategy for Sustainable Agricultural Mechanization: Sustainable Mechanization across Agr-Food Chains in Asia and the Pacific Region. Rome, Italy: Food and Agriculture Organization, 2014.
12. Moss AS. Mechanized Agriculture: Machine Adoption, Farm Size, and Labor Displacement. The Journal of Agrobitchonology management & economics Ag Bio Forum: 2016, 18.
13. Umar N. Status of new agricultural technology at farm level in Aligarh District. 2017; 3(8):734-741.
14. McNeely J, Scherr S. Common ground, common future: How ecoagriculture can help feed the world and save wild biodiversity, 2001.
15. Wood, Stanley, Kate Sebastian. S.J.S. Pilot Analysis of Global Ecosystems. 2000.
16. Huang Y. Understanding China's Belt & Road Initiative: Motivation, framework and assessment. China Economic Review Elsevier Inc. 2016; 40:314-321. 10.1016/j.chieco.2016.07.007.
17. FAO W. The State of Food Insecurity in the World: Economic Growth Is Necessary But Not Sufficient to Accelerate Reduction of Hunger and Malnutrition, 2012.
18. CSAM-UNESCAP Regional Forum on Sustainable Agricultural Mechanization in Asia and the Pacific 2013. 2013, 115.
19. Pinstrup-Andersen P. Food security: definition and measurement. Food Security. 2009; 1(1):5-7. 10.1007/s12571-008-0002-y.
20. Melorose J, Perroy R, Careas S. World population prospects. United Nations. 2015; 1(6042):587-92. 10.1017/CBO9781107415324.004.
21. Prosekov AY, Ivanova SA. Food security: The challenge of the present. Geoforum. 2018; 91:73-77. 10.1016/j.geoforum.2018.02.030.
22. Schmidhuber J. National FTP of the undefined Global food security under climate change. National Acad Sciences n.d., 2007.
23. Burchi F, De Muro P. From food availability to nutritional capabilities: Advancing food security analysis.

Food Policy Elsevier Ltd. 2016; 60:10-19. 10.1016/j.foodpol.2015.03.008.
24. Resilience B. Peace, F.O.R.; Security, F. The state of food security and nutrition in the world, 2017.
25. World Bank Poverty Overview. World Bank, Washington DC.; n.d.
26. Pervaiz B, NinGui L, Manzoor MQ, Yaseen M. Socio-economic characteristics of farming community and food security situation in Punjab, Pakistan. Journal of Agricultural Science (Toronto). 2017; 9(8):130-142. http://dx.doi.org/10.5539/jas.v9n8p130.
27. Government of pakistan National Food Security Policy. 2017.
28. Kanter DR, Musumba M, Wood SLR, Palm C, Antle J, Balvanera P, *et al.* Evaluating agricultural trade-offs in the age of sustainable development. Agricultural Systems Elsevier B.V. 2018; 163:73-88. 10.1016/j.agsy.2016.09.010.
29. Government of Pakistan Pakistan Economic Survey 2003-2004; 2004.
30. Govt. of Punjab Punjab development statistics.Annual report Pakisatn, 2013.
31. Arshad PM. Pakistan soil resources, issues, threats, ongoing activities and their sustainable management National Soil Resources of Pakistan Total area. 2015; pp. 13-15.
32. Godfray HCJ, Beddington JR, Crute IR, Haddad L, Lawrence D, Muir JF, *et al.* Food Security : The Challenge of. Science. 2010; 327:812-818. DOI: 10.1126/science.1185383.
33. Amanda Briney. All You Wanted to Know About the Green Revolution, 2018.
34. Goldman A, Smith J. Agricultural transformations in India and Northern Nigeria: Exploring the nature of Green Revolutions. World Development. 1995; 23(2):243-263 10.1016/0305-750X(94)00115-F.
35. FAO, IFAD, WFP. The State of Food Insecurity in the World: Meeting the 2015 international hunger targets: taking stock of uneven progress, 2015, I4646E/1/05.15.
36. Ruel M, Garrett J, Morris S, Maxwell D, Oshaug A. Urban challenges to food and nutrition security: a review of food security, health, and caregiving in the cities, 1998.
37. Emami M, Almassi M, Bakhoda H, kalantari I. Agricultural mechanization, a key to food security in developing countries: Strategy formulating for Iran. Agriculture and Food Security BioMed Central. 2018; 7(1):1-12. 10.1186/s40066-018-0176-2.
38. Geoffrey Mrema, Peeyush Soni RSR. A Regional Strategy for Sustainable Agricultural Mechanization. Sustainable Mechanization across Agri-Food Chains in Asia and the Pacific region, 2015.
39. Kienzle J, Fao BS. Agricultural mechanization strategies for sustainable production intensification : concepts and cases from (and for) sub-Saharan Africa. 2013, pp. 1-17.
40. Mr. Zeeshan Haydar, Mr. Arfan Arshad Today's Agriculture Needs Farm Mechanization. 2018; pp. 3-7.
41. Lu FM. The role of agricultural mechanization in the modernization of Asian agriculture Taiwan's experience. Engineering in Agriculture, Environment and Food Asian Agricultural and Biological Engineering Association (AABEA). 2009; 2(4):124-131. 10.1016/S1881-8366(09)80003-7.
42. Shahid LA, Saeed MA, Amjad N. Present Status and Future Prospects of Mechanized Production of Oilseed Crops in Pakistan-a Review. 2010; 23(1):83-93.
43. Iqbal MA, Iqbal A, Afzal S, Akbar N. In Pakistan, agricultural mechanization status and future prospects. American- Eurasian Journal of Agricultre and Environment Science. 2015; 15(1):122-128. 10.5829/idosi.aejaes.2015.15.1.12500.
44. United States Agency for International Development (USAID) Pakistan's food and agricultural system. Country Analytic Project, Nathan Associates Inc., Washington, D.C., 2009.
45. Food and Agriculture Organization (FAO). FAO statistical year book 2014. Regional office for Asia and the Pacific, Bangkok., 2012.
46. Farooq M. S.I.A. and A.M. Developments in mechanical planting of sugarcane. Agricultural Mechanization in Asia, Africa and Latin America. 1992; 23(1):28-32.
47. Younis M, Sabir M, Iqbal M, AA. Comparative performance of zone till sowing, slot planting and conventional sowing technique of wheat in rice-vacated fields. Journal of Agricultural Research. 2006; 44(1):59-70.
48. Safdar M, Asif M, Ali A, Aziz A. MYCJ of undefined Comparative efficacy of different weed management strategies in wheat. search.proquest.com n.d., 2011
49. SKT, IH, MS, NSK, SGA. Effects of Different Planting Methods on Yield and Yield Components of Wheat. Asian Journal of Plant Sciences. 2003; 2(10):811-813 10.3923/ajps.2003.811.813.
50. Abbas G, Ali MA, Abbas G, Azam M, Hussain I. Impact of planting methods on wheat grain yield and yield contributing parameters. Journal of Animal and Plant Sciences. 2009; 19(1):30-33.
51. Iqbal M, Munir A, Ahmad M, Hussain K. Evalua tion of Energy y Effici ient Zon ne Disk k Drill for So wing Wheat after Ha arvestin ng Paddy y Crop. 2012; pp. 633-636.
52. Tanzeel ur Rehman, Muhammad Usman Khan, Muhammad Tayyab*, Muhammad Waqar Akram, M.F. Current status and overview of farm mechanization in Pakistan – A review. AgricEngInt: CIGR Journal, 2016, 18.
53. Ejaz K, Tahir A, Khan MT. Performance Evaluation of Modified Self-Leveling Boom Sprayer. International Journal of Agriculture & Biology. 2004; pp. 636-638.
54. Miller P. Protection, M.E.-C undefined Effects of formulation on spray nozzle performance for applications from ground-based boom sprayers. Elsevier n.d, 2000.
55. Tahir A, Khan F. Agriculture, A.K.-I.J. of undefined Effect of constant flow valves on performance of pesticide sprayers. academia.edu n.d., 2003.
56. Tahir A, Khan F. Agriculture, K.E.-I.J. of undefined Techno–Economic Feasibility of Combine Harvester (Class Denominator)–A Case Study. academia.edu n.d., 2003.
57. Ahmad S, Iqbal M. M.A.-P.J. of undefined Design improvement of indigenous beater wheat thresher in

Pakistan. pdfs.semanticscholar.org n.d., 2013.
58. Clarke LJ. Strategies for agricultural mechanization development the roles of the private sector and the Government Agricultural Support Systems Division Table of Contents Forward..... ..... Error ! Bookmark not defined. Policy, 2000.
59. Mada DA, Mahai S. The Role of Agricultural Mechanization in the Economic Development for Small Scale Farms In Adamawa State. The International Journal Of Engineering And Science. 2013; 2319-1813.
60. Bank W, Asia S, Bank W. Innovations in agricultural mechanization for food security in Asia, 2014; pp. 1-23.
61. Schwartz R, Baumhardt R, Research SES. Undefined Tillage effects on soil water redistribution and bare soil evaporation throughout a season. Elsevier n.d., 2010.
62. Usman K, Khalil S, Khan A. Uundefined Tillage and herbicides impact on weed control and wheat yield under rice–wheat cropping system in Northwestern Pakistan. Elsevier n.d., 2010.
63. Dr. Syed Ghazanfar Abbas. 2nd Regional Forum on Sustainable Agricultural Mechanization in Asia and the Pacific, 2014.
64. The Pakistan Bureau of Statistics Pakistan Statistical Year Book, 2016.
65. Dobermann A, Nelson R. Opportunities and Solutions for Sustainable Food Production background research paper Submitted to the High Level Panel on the Post-2015 Development Agenda Opportunities and Solutions for Sustainable Food Production Background paper for the High-Level Panel of Eminent Persons on the Post-2015 Development Agenda, 2013.
66. United Nations Food and Agriculture Organization of the FAO's role in water, 2017.
67. Helen Chin WH. The Belt and Road Initiative : 65 Countries and Beyond. Fung Business Intelligence Centre 2016, (May), 16 https://www.fbicgroup.com/sites /default/files/B%26R_Initiative_65_Countries_and_Beyo nd.pdf.
68. Plan LT, Corridor CE. Long Term Plan for for China-Pakistan Economic Corridor China-Pakistan Economic Corridor Long Term Plan for China-Pakistan Economic Corridor (2017-2030) CPEC China-Pakistan Economic Corridor, 2017.