ANALYSIS OF THE EFFECTS OF TECHNOLOGICAL CHANGES ON INDUSTRIAL LOCATIONS: A REVIEW

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ABSTRACT

Technology is concerned with ways of making or doing things, and sometimes a technological change in one area leads to a change in others. This underscores the need for this review in order to determine the changes in the effects of some industrial location variables through time. From this review, the possibility of substituting one source of energy for another has been important in changing emphases in industrial locations over time. Presently, oil, coal, natural gas, nuclear, and hydro-electric powers can be used to produce electricity which has the advantage of being transported economically over considerable distances. In this regard, industries are able to locate primarily on the basis of other considerations than power. In many of the early industrial activities, location decision were guided by the attainment of maximum profits, while in the modern industries there is a great tendency for promoter's personnel consideration to override other economic issues in the choice of plant's location. Also, in the future locations, government regulations may stand out as crucial to the majority of firms. Over the years, issues on weight/bulk, perishability of products, higher freight rates on finished products, and personal contact between the producers and consumers are dominant market features in industrial locations. In addition to these in the contemporary industrial locations are volume of sales and demand for industrial products, development in transport facilities which makes transport easier, linkage effects, and advantages of industrial agglomerations. The results of the recent studies show that transport is no longer given a strong consideration in industrial locations because improvements in transport technology have reduced the friction of distance and made it more efficient. Also, transport cost has diminished as a percentage of total cost of production. However, in the less developed areas, industrial locations are towards urban areas because they have improved communication facilities unlike rural counterparts. Except for some very specialized industries, proximity to raw materials is no longer an important factor in industrial locations. The reason being that as technology improved, former physical constrains become less significant in location decisions. The quantity, quality, cost, and availability of labour have been significant in industrial location decisions, but the introduction of mechanization and automation in 18th and 19th centuries and availability of labour becoming ubiquitous have greatly reduced the importance of labor in the choice to locate industrial activities.

KEYWORDS: Industry, Location, Location factor, Location changes, Time.

INTRODUCTION

Location on the earth has significant effects upon human activity since it answers the question ''where'' phenomena are on the surface of the earth (Alexander, 1963).Location is the fundamental geographic fact of which the evidence is contained in the idea of Haggett (1983) that three words which geographers use a lot are space, location, and place (particular position on the earth's surface). Location always carries the idea of the way things are distributed and the way movements

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occur over the whole or a part of the surface of the earth (Dicken and Pitts, 1963; and Version, 2005). In fact, location operates under all economic systems, and decisions about location are part of the over-all investment process (Carr, 1987; and Doyle, 2004). Location is an important aspect of industry because it is "location" that matters the most (Wong, 2007). Hence, location is essential ingredient in understanding the economic activities in a world that varies conspicuously from place to place in both human and natural environments.

In industrial location decisions, technological changes referred to as changes in behaviour induced by changes in technology (inventions of tools, techniques or methods, and processes including ways of making and doing things (Bame, 2003 and Reynolds, 2004)) such as changes in number and organization of business, the number and kinds of products produced, production processes and methods (Cortright, 2001b; Yang, 2004), and advances are important. According to Rural Business Forum (RBF) (2007), an important feature of industrial location is its dynamism. The location factors are constantly changing such that initial factors favouring a location may no longer apply in the modern society because the new society and economy are marked by a fundamental change in the character of the modern technology. For instance, automation affects the locational factors of space and labour in such a way that the industries are growing more footloose (those industries which are less dependent on factors that tie them to a specific geographical location) than they were formerly. In agreement, Intel Corporation (2005) showed that in recent times industries have shown themselves to be very footloose in terms of location. Therefore, changes in technology have significant effects on the patterns of distributions of business activities (Cortright, 2001a). Mcquaid, Greig, Smyth, and Cooper (2004) supported this by saying that the abilities to develop and utilize new technologies are important for a firm and affect location choices. Such changes as found by Estall and Buchanan (1966, 1973) and Mcquaid et al (2004) are in areas of; Power/energy, Individual taste, Market or demand factor, Transportation facilities, Raw materials as well as techniques in mineral exploitation and utilization, Important of labour, and Industrial agglomeration tendencies.

Changes in Demand and use of Energy/Power

Energy is the ability to do work (motion against resistance) (Asimov, 2003). Energy is very important because it is required in various forms at every stage of industrial activities. Industries require energy for two major reasons-to provide heat or as a motive force (Haggett 1983). Many sources of energy are available for the modern industries. They include; animal, wood, water, coal, petroleum (oil and natural gas) and nuclear energy sources (Udo, 1982; Chiras, 1991; Asimov, 2003). The possibility of substituting one source of energy for another in many industries has been important in bringing about changing emphases in the locations of industries over time. This is because of technological advancement, which has progressively altered the conditions of demand for energy. The effect of energy supply on industrial location may usefully adopt a chronological approach as shown on Table 1.

To Miller and Langdon (1964), before the second half of 18th century, the most potent restriction on the location of any considerable industrial activity was the need for fuel and for power in quantities beyond that provided by human or animal muscle. This caused the main

locations during the medieval period (500-1500 A.D) to be where fuel (mainly wood), and power from water and wind were available (Hammond, 1979 and Waugh, 1998).

The direct use of water power was a very important stage in industrial development during the early 18th century because the quantity of power provided reached significant proportion. Water provided a steady source of power for many centuries and man responded by selecting industrial sites near swiftly flowing streams which provided the energy to drive mills and machines (Bale, 1981). For example, motive power throughout most of history was limited to locations with falling water (waterfall) such that mills and production machines could only be located in such places (Cortright, 2001a and b). But, techniques of harnessing and applying the power were not adequate to exploit the larger flows coupled with the fact that capital requirement was large relative to the quantity of power obtained. By the time these difficulties could be overcome, coal was forming an alternative source of power, and water sites became of decreasing importance in the locations of industries. In the 18th century, new discoveries and inventions promoted a wider use of coal both as a fuel and as a source of power (Crafts and Mulatu, 2006).

TABLE 1: The chronicles of energy sources

SOURCE	APPROXIMATE TIME	SPECIFIED USES
Man and Animal	Prehistoric (time before recorded history)	Transportation
Wood	Prehistoric and Early historic (1880)	Domestic cooking, space heating, and handicraft.
Wind	Early historic period (time of known and recorded history)	Transportation
Water	Pre- historic-18th century	Handicrafts, crude mills, and transportation.
Coal	13th –20th century (1920)	Domestic cooking and space heating.
Steam power	18th –19th century	Steam engines for factories, and transportation
Petroleum	19th (1859) –20th century	Space heating, domestic cooking, lighting, motors for transportation
Electricity	Late 19th –20th century	Motors for factory machines, transportation, space heating and lighting, and domestic looking.
Wood, coal, petroleum	Early 20th century	Generation of electricity.
Nuclear energy	2nd half of 20th century	Generation of electricity and specialized uses like manufacture of nuclear weapons.

(Source: Bengtson and Royen, 1943; Thoman and Corbin 1974; Miller and Langdon 1964; and Stanford and Moran, 1969).

By mid-19th century, steam power played part in manufacturing locations and brought profound consequences for industrial location especially in U.S.A (Crafts and Mulatu, 2006). In reaction to this, Cortright (2001 b) and Intel Corporation (2005) illustrated that with the advent of steam power and later electricity, motive power became essentially pervasive, and access to motive power ceased to be a decisive factor in the location of industries except for large-scale power generation. Thus, steam overcame the serious limitations of water, being more reliable and within limits more mobile to become the principal reason for the growth of the great industrial concentration on the coal fields of U.K. After the industrial revolution which started in Britain and U. S. A, coal overrode all other factors in determining the growth of major industries (Hammond, 1979; Intel Corporation, 2005). But as coal was bulky and expensive to move, canals and railways were constructed to move coal and these affected changes in location because new industries were located along transport routes.

Intel Corporation (2005), and Waugh (1998) indicated that by the middle of 20th century, oil was being increasingly used as it could be transported easily by tanker or pipeline, and this began to free industry from the coalfields and to offer it a wider choice of location. Therefore, from 1921 to the present there is a relative decline in the use of coal and the rise in the use of petroleum (Miller and Langdon, 1964), and in the 1960s coal was succeeded as the world's biggest source of industrial energy by oil (petroleum) (Boyd, 1991). This encouraged repercussions on industrial location because oil possesses advantages of transportability, easily handled in loading and discharging, less volume, higher energy value, lower cost of movement, clean and relatively convenient, and more easily controllable. However, the main effects of oil as an energy source upon the location of industrial activity result from its relative mobility. Thus, power supplies in the modern world possess a flexibility tendencies which have greatly reduced its influence on location decision (Paterson, 1976) since new forms of power (electricity) were introduced and the means of transporting them were made easier and cheaper.

Presently, oil, coal, natural gas, nuclear, and hydro-electric powers can all be used to produce electricity to feed the national gird. This is because electricity in addition to its cleanliness and flexibility has the advantage of being transported economically over considerable distances. In this regard, availability of energy has diminished in importance as a locational factor because energy is now an ubiquitous resource. However, some energy intensive industries such as smelting need to be near cheap and abundant power supplies (Intel Corporation, 2005). Thus, in the modern industrial locations, power comes from different sources, and can even be transmitted via high –voltage electrical lines over long distances. Therefore, manufacturers are able to locate primarily on the basis of considerations other than power (Barcelona Field Studies Center (BFSC), 2007) except when an industry really needs exceptionally large amount of energy like metallurgical and chemical industries (De Blij and Muller, 1986; Intel Corporation, 2005).

Spurred by projections of enormous electrical demand and oil crises a shift to other sources of electricity has begun. France and Soviet Union have opted to produce electricity with nuclear energy on a large scale, while Brazil has chosen ethanol produced from sugar cane to power her fleets of trucks and cars.

Nowhere are the signs more evident than in the nuclear power industry as in U.S.A. because it produces very little air pollution and does not produce toxic gases such as sulphur dioxide and nitrogen dioxide which are converted into acids in the air, though it has high cost of construction and production (Chiras, 1991). Another significant feature of energy that affects industrial location is differential energy rates. In Nebraska, U.S.A, Gates (2006) gave example that low energy rates and nationally recognized service provided by the Omaha Public Power District (OPPD) are among the major advantages of selecting business locations in Southeast Nebraska. While other energy costs are rising, OPPD has maintained rates that are well below the national average (Gates, 2006).

Changes in Individual Taste and Industrial Locations

In the location decisions, some industrialists look for the best location, while others accept locations that are good enough. Those who look for the best locations are referred to as maximizers i.e. people who want the absolute best in the location decisions (Lassiter, 2004). By this, the choice of location is difficult because to maximize is to meticulously analyze and compare every possible option or examine every choice (Lassiter, 2004; Hess, 2005). The maximizers are externally motivated because they are not looking at themselves, but at others in order to see if what they have is better.

On the other hand, those who look for locations that are good enough, are called satisficers i.e. people who look at the options and choose options that are good enough (Lassiter, 2004). Thus, to satisfice is to limit the number of options considered and accept the ones that are satisfactory (Hess, 2005). Satisficers are internally motivated since they accept locations that are good enough to sustain their businesses. However, they explained that beyond this constraint of a satisfactory profit, cooperate managers may tend to emphasize personal factors rather than maximizing profits. These ideas are behind any locational decision making, and either of them is profitable at varying rates depending on the taste of the industrial proprietors.

Many of the early industrial activities were located with the profit motives in which economic interests were chosen in favour of taste pertaining to satisfaction. Thus, location decisions were guided by the attainment of maximum profit. In the modern industries, plant ownership is an essential factor in location decision (South, 1990; Ogbu, 1998), and there is a great tendency for promoter's personal considerations to override other economic issues in the choice of plant location. In agreement, Warn (1995) stressed that often, it is the view point of an individual or the collective assessment of a board of directors which makes the final locational decision concerning where to set up a new factory or a new branch. The evidence of this are contained in Ogbu's (1998) study of industrial location factors in which he discovered that among the 23 industrial location factors, satisficer effects contributed 18.7 percent out of 87.4 percent in the locations of industrial plants in Enugu State, Nigeria. Also, Judy (2002) found that many companies in Mexico locate where their founders lived when they started the companies. Thus, non-rational reasons still are among the most important factors influencing cooperate location decisions. Moreover, Herrin and Pernia (1987) and Stiperski (1995) mentioned that in the future locations, government regulation will stand out as crucial to the majority of firms. Such influences are mainly in the severe policy measures as in

guidance/persuasion, ban, regulations like pollution, financial pressures such as penalties and taxes, financial incentives, improvement to infrastructures, and establishment of industrial estates (Badri, 2007; Aranya, 2007; SEQ, 2001; Grahame, Mark and Arti, 2001). An industrial estate is a group of factories constructed on an economic scale in suitable sites with facilities of water, transport, electricity, steam, bank, post offices, canteen and ward and first-aid, and provided with special arrangements for technical guidance and common service facilities and district (Alexander, 1963; Herrin and Pernia, 1987). Again, there are two vital controls over the factory and its processes – the industrialists who set the whole thing up, and government policies which affect their decisions. The human factor is thus, the most important factor in industrial location (Stiperski, 1995) and as the firm's decision makers develop better identification, analysis and assessment of these critical factors, the location decision making process will improve and result in effective long term performance (Badri, 2007).

Changes in the Relative Importance of Market

Market is people with desire for goods and the ability to buy them (Standard Data Resources Ltd, 1987; Musa, 1992; Auty, 1995). It is a place where goods are sold (Warn, 1995) as well as consumers (people) are located as pointed out by Wilczewski, Lijewski and Kortus (1978). Market strength varies and it is this strength that has continued to attract industrial plants to their markets over the years. According to BFSC (2007), and Wong (2007), in the market oriented firms, the weight loss of materials and components is small compared to the weight gain in their processing. An example of this as shown by Udo (1982) is the brewing industries like beer and soft drinks in which the finished products are much heavier and bulkier than the raw materials.

Industries in which the cost of transporting the finished products is much higher than that of the raw materials or forms a high percentage of the total costs should locate near the market (Paterson, 1976; Clark, 1982; Rubestein, 1986; BFSC, 2007). They also observed that market locations are important if ubiquitous materials are involved and where the products are more fragile, perishable, cumbersome to pack and handle or are of low unit value. Again, Evans (1975) and Morris (2007) discovered that industries that ship to local consumers such as newspaper, bakeries and dairies have sought market locations. This is in order to minimize both the average delivery time and the average distance traveled to customers since the cost of transport must be held to a minimum because of comparatively low value of the delivered product. .

The importance of market has also been augmented in the locations of the contemporary industrial plants where the size of market and the developments in the modern means of transport have increased the attractions of the market forces in the location choice of industrial activities. This is the reason why Warn (1995) explained that the concern of industries is the potential size of markets especially for widely used consumer products. In support of this, South (1990) and Morris (2007) opined that market uncertainty can be minimized by considering only large urban places as potential plant sites, and South (1990) observed that Cindad Juarez and Tijuana were favoured in the locations of industries because they are the largest border cities in Mexico. Moreover, Montevideo (the capital of Uruguay) grew in industrial activities because demographically her population (market

strength) stagnated around 1.2m inhabitants (Bahr, 1990), while Northern Darfur in Sudan became a large market center because her people created demand for carpets by working with the wool of their animals (Camels, sheep, and goats)(Ibrahim, 1996). In U.S.A, rural areas are attracting business investments because more people with disposable income who enter into retirement age relocate and change the rural environment demographically (RBF, 2007). This trend as observed by RBF (2007) transcends national boundaries, for it can be seen not only in U.S.A, but in Canada, Europe, and other regions of the world. To Auty (1995), eastern Brazil developed economically as a result of the presence of large population (market) for her industrial products. Barton, Figuiere and Simon (2007) argued that European firms in the fertilizer and steel industries made important investments in developing countries for a desire to participate in rapidly growing markets. In contrast, Brucher (1980) in his study of industrial activities in Colombia (South America) discovered that Baranquilla in the north of Colombia is poorly developed in industries due to the fact that only few populations exist there.

Therefore, market strengths in influencing industrial locations over the time are not the same. In the first half of 20th century, the issues on weight/bulk and perishability of products, higher freight rates on finished products than raw materials, and personal contact between the producers and consumers were dominant factors in industrial locations. Though, these factors are still important in the market attractions of the contemporary industrial locations, but more vibrant features of market are considered. They are the size of market which is considered in terms of volume of sales and demand for industrial products, developments in transport facilities in order to make transport easier, cheaper and reduction in the effect of the friction of distance, and the linkage effects as well as the advantages of industrial agglomerations.

Changes in the Relative Importance of Transport

Transport is a positive precondition to economic development of an area (McCalla, 1983). Thus, transport is an integral part of the productive process since a good is useless until it gets into the hand of the consumer. Industrial location decision relates to the movement of materials of all kinds from source to factory and of products from factory to market. Therefore, it is required at both the input and output stages of production (Warn, 1995; Intel Corporation, 2005) because good transport provision in an area will increase effective market size and competition in any given area, thus allowing a greater number of business to operate (Mcquaid, et al, 2004).

In the early stages of the development in industrial locations, the difficulty of transport acted strongly upon the location of industrial enterprise. By this period, industrial locations were affected by the stages of developments in the transport system. By the first half of 19th century, locations were favoured by coastal towns, estuarine towns, and towns on navigable rivers because inland transport was slow and highly expensive. With the construction of canal which was preceded and was accompanied by schemes of river improvements, industrial locations shifted to coalfields because coal was essentially bulky raw material.

As changes in industrial locations progressed and the railways appeared, canals became undesirable and less necessary to endure. Canals were slow,

interrupted by many locks, narrow and difficult to maintain especially in dry season. By the second half of 19th century, railway favourably competed with canal to become important consideration in industrial locations (Estall and Buchanan 1966, 1973). Railways permitted greater flexibility in the movement of goods and raw material, were faster, easier to construct and maintain.

The 20th century brought road transport to the fore (Hoover, 1963). This was unparalleled to others (canal and railway) because of greater flexibility. Most industries found road transport more successful than rail even over long distances. For valid reasons, new roads near major centers of population proved irresistable magnet to industrial locations of the time.

In the opinions of Nixson (1973), Yoshida (1984), Hennings (1992) and Mollung (2007), the main features of transport necessary in industrial locations in the second half of 20th century were transport costs, characteristics of raw materials/products and transport availability. Example, Weisbrod (2006) who studied industries in Ohio (USA) said "build a highway and they (industries) will come." Also, Mcquaid et al (2004) indicated that transport can affect business location through transport costs of goods, relative time costs and savings, certainty/reliability of travel time, the need to physically meet customers and suppliers, and staff and customer travel costs.

However, towards the end of the 20th and beginning of 21st centuries many contributions were on the fact that transport generally is no longer given a strong consideration in industrial locations. This is because transport technology has improved and transport cost has diminished as a percentage of total cost of production (Warn, 1995; Cortright, 2001a and 2001b). Also, in the view of Intel Corporation (2005), modern developments in transport have made it more efficient and more cost effective such that industrial location has dispersed from its traditional locations. In agreement, Cortright (2001a) stated that improvements in transportation and communication have the effect of making more things ubiquitous, and therefore irrelevant to location choice of economic activities. Moreover, Waugh (1998) highlighted that transport costs are only 2-3 percent of total expenditure of the British firms. Stiperski (1995) did not even include transport among the industrial location factors in his study on the hierarchy of industrial location factors, an example of West Croatia, Europe. In the same vein, the effects of transport were not included in both the main and local factors affecting industrial locations in Iredell country of Republic of South Africa (Elmquist, Meyer, Evans and Wrubel, 1999).

Another significant issue is the effect of Information and Communication Technology (ICT) on the level and distribution of economic activities. Changes in ICT have not merely shifted the patterns of demand among categories of products, they have driven the growth in the number of different products produced. For instance, in their study of three industries in London, Cook and Pandit (2004) pointed out that changes in demand as a result of changes in ICT played significant part in the changing pattern of industrial locations from North to the South. In another perspective, improved communication makes the physical proximity of information less relevant since logistical needs of business are now available almost ubiquitously (Cortright, 2001 b; Yang, 2004). This is the reason for the submission of Krueger (2006) that the development of telegraph and the telephone made it easier to place

and track orders over long distances. Mcquaid et al (2004) described it as a new way of working and communicating instantaneously with a large number of people spread across a range of physical locations and distances, and provides potential flexibility to work wherever and whenever one wants.

The trend in location is towards urban areas because they have improved communication facilities (Mano and Otsuka, 2000). A study in Portland by SEV (2002b) proved the importance of ICT in industrial location because five out of seven firms considered it important in their location choices. Yang (2004) found that the locations of the contemporary industries in Australia are highly dependent on technological infrastructure in which information technology is viewed serious.

Technological Changes in Raw Material Attractions.

Any materials from which products are made or that require processing before consumption are called industrial raw materials (Bale, 1981). It is natural or partially manufactured products that are used to make a new product (Cohn, 2003). They are either natural if they are found in nature or synthetic (product by the assembling of separate or subordinate parts into a new form) if man made them from natural substances like petroleum or cellulose (material from plants such as cotton).

In the past, few of them were known and used to make products. Presently, many different materials can be used as a result of technological changes in their exploration, extractions, productions, and substitutions. Until the end of 20th century, raw material was very attractive in industrial locations (Crafts and Mulatu, 2006). This was in such raw material features as bulk, weight, availability, and perishability. Raw material sources were important where the input materials were perishable or difficult to handle in transit weigh more than the products, and bulky (Clark, 1982; Onokerhoraye, 1985; BFSC, 2007; and Wong, 2007).

One major locational factor is the presence of raw material, which is essential to all manufacturing. Therefore, industrial establishments are concerned with their locations relative to their materials and to the costs of procuring them. For instance, Waugh (1998) showed that industries in 19th century particularly in Britain were often located close to raw materials (iron works near iron ore) mainly due to the immobility of the raw materials which were heavy and costly to move when transport was expensive and inefficient. However, as technology improved, former physical constraints became less significant due to improved transport and technology, greater sophistication and complexity in modern industries and the relative increase in the importance of other locational factors (Hammond, 1979). Hence, with improvements in transport and changing industrial circumstances this factor is of less relevance in the locations of modern industries than it was in the 19th century (Norton, 1992; Crafts and Mulatu, 2006). There is now a greater efficiency in the use of raw materials, components for many modern and especially high-technology industries are relatively small in size and light in weight, and some firms may simply rely on assembling component parts made elsewhere.

Subsequently, as manufacturing becomes increasingly complex, most industrial firms purchase partially manufactured commodities from widely distributed sources (Miller and Langdon, 1964). The reason is due to the introduction of techniques of preliminary treatment of primary raw materials (example, beneficiation and fabrication) which reduce the quantity of waste and

increase their transportability. Thus, the influence of raw material on location of industries has declined in recent times due to the improvements in transport and efficiencies in their use. For such reasons, much of the modern industries are less seriously affected in their locations by the locations of their raw materials except those industries using raw materials that are low in value in relation to their weight or bulk or perishable, loose weight or bulk during the manufacturing process, and for plants designed to upgrade some mineral ores before export (Udo, 1982; Waugh, 1998) or those industries that extract their products from the physical environment directly.

Changes in the Importance of Labour

The quantity, quality, cost, and availability of labour have been significant since early 20th century in the industrial location decisions as found by Paterson (1976), Wilczewski, Lijewski and Kortus (1978), Warn (1995), South (1990), Morris (2007) and Wong (2007). The introduction of mechanization since 18th and 19th centuries has changed the relative importance of labour in the choice of locations of industrial activities. Mechanization is the introduction and the use of machines in an industrial process in order to enhance, lighten or replace human power (Clark, 1982). An illustration was given by Intel Corporation (2005) that in many cases nowadays mechanization has reduced the requirements of a large skilled workforce.

Another development that affected the demand for labour since early 19th century is automation in industrial activities. Automation is a way of making a machine, process or system to operate without constant human control (Lawley, 2004; Gwinn, Norton and Geotz, 2005). Here, machine regulates and coordinates the quantity and quality of what is produced. It enhances product quality, achieves repeatability without changes in the product. It replaces unskilled jobs, but increases the demand for highly skilled workers (Lawley, 2004). In automation, the development of feedback systems distinguishes it from mechanization. A feedback system is the ability of a machine to regulate and adjust itself in the production (Gwinn et al, 2005; Muir, 2002). An example as given by Muir (2002) is a home heating system controlled by a thermostat. The first industrial automation (Robot) was used in automobile in 1961 in Europe (Lawley, 2004). Robot is a mechanical device that operates automatically, performs a variety of tasks, and suitable for doing jobs too boring, difficult or dangerous for people (Kazerounian, 2004).

Moreover, high technology industries or research and development companies are located in areas where the workforce is highly-educated or skilled and labour-intensive industries are located in regions where there are vast numbers of unskilled and low-cost labour (Wong, 2007). On this, Carter (2007) explained that the bigger the talent pool of labour the easier it will be to build teams that will drive business forward.

Changes in the Effect of Agglomeration in Industrial Locations

In the locations of industries in the 21st century is the increase in effect of clustering or agglomeration of economic activities. Agglomeration is a process of firms congregating in a certain region or zone because of certain advantages in

doing so (Akerman, 2003). In other words, it is a co-location of firms in the same industry. To Raines (2001), agglomeration or cluster applies to a variety of distinct industrial processes in an area. In agreeing with Raines (2001), Judy (2002), and Mcquaid et al (2004) observed that an industrial cluster is a set of industries related through buyer-supplier and supplier-buyer relationships or by common technologies, distribution channels, and labour pools. As industries cluster, many different industries interact with each other in such a way that some firms compete, while others complement (SEV, 2002 a).

Agglomeration occurs principally because particular areas have developed a local comparative advantage in one or another kind of economic activity or because firms realize monetary benefits from sharing specialized input factors. This generates externalities that enhance productivity of all firms. The externalities that result to clustering according to Lall and Chal (2004), Lall and Chakravorty (2006), Kathuria and George (2005), Akerman (2003), Stirm and St-Pierre (2003) and Wong (2007) include;

i) Firms that utilize the same technologies and employ similar workforce with one another and share information particularly if they have similar problems. Such information sharing may also be on how to develop new technologies.

ii) Low cost of production through the reduction of transaction costs faced by firms as in those that require face-to-face interactions.

iii) Accessibility to services like maintenance and supply that are provided by other firms, and proximity of supporting companies or sub-contractors. This ensures certainty because both the producers and customers know when a package will arrive.

iv) Local industrial diversity which is a factor with significant and substantial cost-reducing effects. These were summed up into three reasons as benefits of a pooled labour supply, access to specialized inputs, and information flows between people and firms (SEV, 2002a).

In addition, availability of infrastructure encourages industrial clustering. Such infrastructure in the opinions of Lall and Chal (2004) can either be physical or social types. The social types are public welfare services such as health, education, research and development, corruption control, political stability, government effectiveness, and business association (Lall and Chal, 2004; Judy, 2002). Therefore, at least for the profit maximizing firms, the presence of a well-developed network of firms in a region is an important factor for their location decisions. The truth of this phenomenon is demonstrated by Cortright (2001b) who discovered that agglomeration economies, once rooted in a particular place, tend to overwhelm the importance of countervailing locational factors, including transportation costs.

CONCLUSION

Over a period of time a new branch of geography forms, its ties with other branches of the science are established, its place in the system is determined, specialist is trained, scientific research is conducted, and a methodology developed. Within the same period the newly- borne specialism must change its

methods or even fade away. This underscores the emphasis on the changing nature of industrial locations in this paper. However, industrial location has experienced gradual, but progressive development ranging from the changing roles of some factors as they influence location decisions to the industrial activities becoming footloose in their locations as a result of technological developments in movement and changing nature of input materials, and the development of other locational factors particularly the behavioural tendencies that greatly influence the location decisions of the contemporary industries.

Industrial location occupies a prime position in the field of industrial geography for it is important in the understanding of the distributions and functioning of the environmental phenomena. Again, things are rationally organized on the earth's surface and the understanding of the spatial patterns, processes, and interactions is the base for the understanding of how people live on and shape the earth.

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