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Article · December 2015

DOI: 10.9770/jesi.2015.3.2(4)

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The International Journal
ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES
ISSN 2345-0282 (online) http://jssidoi.org/jesi/aims-and-scope-of-research/
2015 Volume 3 Number 2 (December)

INDUSTRIALISATION FACTORS IN POST-INDUSTRIAL SOCIETY

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Received 16 September 2015; accepted 30 October 2015

Abstract. In most economies, both developed and developing, industrialisation is viewed as a necessary step towards economic development. New risks for industrialisation are associated with the result of the economic and social changes, regarding the transition to a post-industrial society. Modern progress of organization theory has generated important questions and challenges to conventional sociological and organizational theories. These developments are related to "conditions of postmodernity" – dynamic environment and a post-industrial society with information and knowledge-based nonhomogeneous values as a central research topic. As a result it should be stressed that nowadays society is directly linked to the adjustments in values as a shift to post-industrial modes of production. Modern industrialisation concept should represent the post-industrial society approach, providing framework for the practical applications and explaining the modern company value creation process that corresponds to the economic transformation into post-industrial.

Keywords: industrialisation, post-industrial society, organization theory, performance, ICT, Internet of Things

Reference to this paper should be made as follows: Shatrevich, V.; Strautmane, V. 2015. Industrialisation factors in post-industrial society, *Entrepreneurship and Sustainability Issues* 3(2): 157-172. DOI: http://dx.doi.org/10.9770/jesi.2015.3.2(4)

JEL Classifications: L16, L23, L61, M1, O14

1. Introduction

Inspecting the origin of the term of industrialisation in Europe, the authors emphasise a major increase of labor productivity due to industrialisation as a significant aspect of the production process. Industrialisation gave a huge advantage over other methods of production and led to the overall development of modern Europe. When considering industrialisation as a contribution to society development, economists point that 'towns and cloth manufacturing obviously existed in Western Europe before the eleventh (11th) century, but the advance in economic productivity was underlined as critical, by using better-qualified workers and by increased artisan creativity, substantial improvements in quality and value of the goods produced per working hour input were realised' (Van Der Wee 1975). The aim of the research is to develop the model of modern industrialisation development into post-industrial economy. The starting point for industrialisation the authors define in the process of technical modernisation. Schumpeter, affirms: 'Inspecting the birth of the modern concept of industrialisation, it is worth noting the process of modernisation' […] 'a degree of modernisation can, and

sometimes does, occur without industrialisation, but industrialisation is usually a basic aspect of modernisation' (Schumpeter 1934). Industrialisation is the totality of relations involving workers, employers and society as they develop to make use of the new machines, processes and services that modern technology has made possible. Industrialisation is usually described by new and more diverse skills, larger-scale productive endeavours, more large cities and much else (Kerr *et.al*.1960).

2. Industrialisation and management theory development

Discussing the contribution of industrialisation in the efficiency of production process, J. Schmiechein also describes industrialisation as a method of centralising resources of the enterprise in order to improve productivity. He also points out the productivity as the fundamental aspects and the basis of industrialisation. The essence of industrialisation 'the dominant tendency to centralize production and labour within the factory' and 'natural progression to greater and more sophisticated economic organisation […] and greater organisation of labour […] new machinery and dramatic technological innovation'… 'Accepted patterns of industrial evolution could be explained by changes in technology, supply of labour, consumer demand, or even urban growth' […]. Fundamental basis for the fast evolution of the productivity theories was established by F. Taylor. Economist Daniel (1992) in his study also indicates that the concept of industrialisation revealed great opportunities and changed its development owing to the research F. Taylor: 'The study of scientific management provides an avenue for understanding the […] interest in economic and technical rationalisation as well as the evolution of production management and the changing character of industrial work in the middle decades of the century' (Schmiechein 1975).

Nowadays, the variety of economic theories offer a huge number of different ways to achieve efficient use of company resources. The following Table 1 is representing the major schools of economic history. The authors underline that industrialisation in its core is also sharing the same concept - to improve the resource management efficiency through the development of technical rationalisation and efficient organisational structure. Kuhn also explains that the new research and standards usually include the basics and concepts of the most famous scientific papers, often complementing and developing them: 'When new paradigm is born from old one; it incorporates much of the vocabulary and apparatus that the traditional paradigm had previously employed, though these elements are employed in different ways' (Daniel 1992). The authors summarize that subsequent management theories (discussed below) have embraced the idea inherent to F. Taylor, they are proposing to improve the resource management (utility of resources) through the development of the organisational structure or optimisation of the production process efficiency using divergent approaches. The authors stress that owing to above mentioned impulse the structure of the organisation has historically been associated with the production process in order to support its functions. The production process and the structure are closely related and complement each other. Process-based companies have become fashionable during recent years. They are a powerful answer to the problems that functional and product-oriented structured companies faced (Vanhaverbeke and Torremans 1998).

Table 1. The schools of historical thought and their components by decade

Theory	Description
Org. theory prior to 1900	Emphasised the division of labor and the importance of machinery to facilitate labor.
Scientific management (1910s)	Described management as a science with employers having specific but different responsibilities; encouraged the scientific selection, training, and development of workers and the equal division of work between workers and management.
Classical school (1910s)	Listed the duties of a manager as planning, organizing, commanding employees, coordinating activities, and controlling performance; basic principles called for specialisation of work, unity of command, scalar chain of command, and coordination of activities.
Human relations (1920s)	Focused on the importance of the attitudes and feelings of workers; informal roles and norms influenced performance.
Classical school revisited (1930s)	Re-emphasised the classical principles.
Group dynamics (1940s)	Encouraged individual participation in decision-making; noted the impact of work group on performance.
Bureaucracy (1940s)	Emphasised order, system, rationality, uniformity, and consistency in management; lead to equitable treatment for all employees by management.
Leadership (1950s)	Stressed the importance of groups having both social task leaders; differentiated between Theory X and Y management.

Decision theory (1960s)	Suggested that individuals "satisfice" when they make decisions.
Sociotechnical school (1960s)	Called for considering technology and work groups when understanding a work system.
Environmental and technological system (1960s)	Described the existence of mechanistic and organic structures and stated their effectiveness with specific types of environmental conditions and technological types.
Systems theory (1970s)	Represented organisations as open systems with inputs, transformations, outputs, and feedback; systems strive for equilibrium and experience equifinality.
Contingency theory (1980s)	Emphasised the fit between organisation processes and characteristics of the situation; called for fitting the organisation's structure to various contingencies.

Source: Fligstein 2001

All the modern management theories of the organisation as well as industrialisation concept have structure as the cornerstone to ensure a more efficient production process (See classical theory to 1900, e.g. 1776 A.Smith (Wealth of Nations), and F.Taylor (1911), A.Fayol (1949) until neoclassical works Mayo (1933) and McGregor (1960) Figure 1).

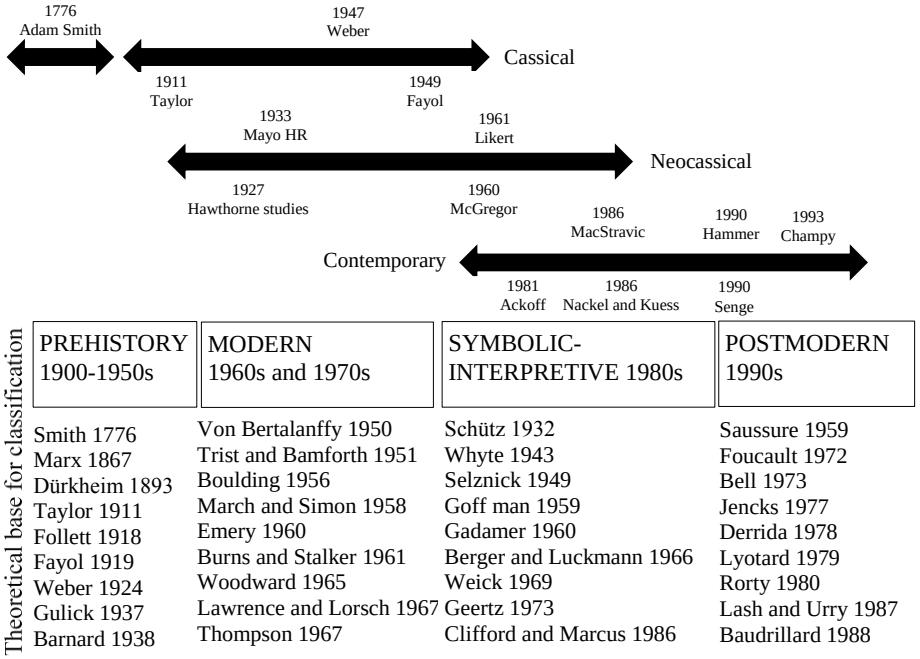


Fig.1. Modern progress of organisation theory and major frameworks

Source: the authors`s created system, based on M.Hatch 2012

Organisation theory has been developed to describe, explain and predict the functioning of organisations in order to improve their effectiveness and efficiency. Even in modern conditions, the organisation's strategy includes the efficiency of the production process as a major competitive advantage in the market, and modern scientific works continue to explore methods of creating the optimal structure to ensure the specific processes within the company.

It can be summarised by saying that modern industrialisation has core methods of improving productivity through centralisation of resources, organisation of labor, optimizing company structure, technological innovation, and modern methods of mechanisation of the production process.

3. Industrialisation and modern society

In order to fully analise and create a picture of changes and development of the industrial economy towards modern society, it is necessary to follow the changes in the concept of industrialisation; management of production processes and the main directions of research in this field. Industrialisation played a central dynamic force at work around the world, which includes political and cultural developments as well. The first

industrialisation footprints could be traced back to Maya Age, "Machine Age Maya" (Whyte, 1959). The most significant event in the development of the world economy through industrialisation is considered to be the First Industrial Revolution (hereinafter FIR). Industrial Revolution has dramatically changed the structure of the world economy, and served as fundamental basis for transforming to its present form. Industrialisation has become the primary incentive for the rapid economic development of the numerous countries. It is crucial to understand the factors which played significant role for industrial process development. Industrialisation at that time was an attempt to use more effective methods of production through mechanisation, the division and the special organisation of labor (see Table 2).

Table 2. Industrializaion major factors groups that influenced world economy transformation during FIR

Factors groups	Impact Description	Author
High productivity of labor through mechanisation	The process of industrialisation is essentially an effort to break with an economic order characterised by a low productivity, impossible or difficult to augment.	J. Orchard, 1960
	Impact of mechanisation during industrialisation 'ease the skilled labor shortage in many instances and lower skill requirements'	J. Brigh, 1958
	Industrialisation's contribution to society development — industrial society is based on a labor theory of value (the authors`s remark derivated from A.Smith and K.Marx).	D. Bell, 1980
	Increases in productivity as a result of the use of mechanical power and machinery", 'the displacement of traditional skills by machinery', and discussed new factory towns.	K. Marx, 1884
Innovation in technology and organisational design	Technological and organisational changes in the cotton industry have been widely studied in attempts to understand the nature of economic change.	E. Hobsbawm, 1968
	Industrial revolution was triggered by the invention of the steam engine, the replacement of hand labor, and the shift to more capital-intensive methods of production.	P. Mantoux, 1961
	Economy development model based on industrialisation elements. Model reviews technology breakthroughs in production process on economy growth; economy growth has recession times, making economical cycles described in Nikolai Kondratiev`s work.	J. Mokyr, 1976
	Innovations in economic organisation, social relationships and technology as structural factors. Concentration of capital and the creation of innovation relationship; an industry cluster presents new opportunities for innovation.	Schumpeterian view, Schumpeter, 1939

Source: the authors`s created major factor groups based on Orchard 1960; Brigh 1958; Bell, 1980; Marx 1884; Hobsbawm 1968; Mantoux 1961; Mokyr 1976; Schumpeter 1939.

After significant technology breakthrough during the 1st Industrial Revolution, the 2nd Industrial Revolution (hereinafter SIR) underlines concentration of capital. Many economists differently explain the incredible achievements of SIR. Higher "capital-labor ratio" or capital density is also considered one of the elements that improve productivity, and due to the fact that capital and labor are mutual substitutes, increasing either capital or labor can raise productivity (Moomaw 1983). Broad number of studies has identified industrial structure, capital density, technology adjustment capacity, labor quality, and agglomeration economies to exist among the main factors affecting urban productivity (Moomaw 1983; Williams and Moomaw 1989; Chandler 1966). Both industrialisation major factors are categorised in Table 3.

Table 3. Industrialisaion majorfactors groups that influenced world economy transformation during SIR

Factors groups	Impact Description	Author
Internal capital concentration (Industrial productivity)	Large, vertically-integrated structures embracing research and development, marketing and distribution, and manufacturing.	D.Chandler 1966
	In neo-classical economic thought, industries typically move from simple to highly concentrated forms of organisation.	F.Scherer 1980; M.Waterson, 1984
	Influential theory of industrial employment in a country. Economic growth leads to an increase of capital in industrial production.	C.Clark 1940, S.Dodzin and A.Vamvakidis 1999
	The density of the capital equipment and related maintenance downtime is associated with industrial productivity	S.Kim 1997
	Large, vertically-integrated production unit generates better production efficiency through economy of scale.	A.Marshall's view 1980
	Full usage of resources and production efficiency characterize industrial development progress and industry scale and positively impact local competitiveness.	I.Begg 1999

	Higher "capital-labor ratio" or capital density.	R.Moomaw 1983
	Manufacturers holding a higher "capital-labor ratio" have more advanced production technology.	J.Kendrick 1977
External capital concentration (Agglomeration)	A new industrial system has been emerged, industrial districts' competitive advantages, and their strong propensity to export.	M.Bagella *et al.* 1998; L.Becchetti and P.Rossi 2000; R.Helg 2003
	Large industries have accessibility to more extensive and cheaper financial and informational resources, and are more efficient in controlling and their existence is threatened less.	A.Rahnama 2011
	In economics, there is a new appeared concept - industrial cluster or agglomeration. The term 'industrial cluster' refers to the company and institutions in close proximity to each other in a particular field and area maintaining an interactive relationship, influencing and supporting each other.	M.Porter 1998; S.Rosenfeld 1997; G.Swann and M.Prevezer 1996
	Industrial district innovative performance is correlated to its specialisation, the existence of suppliers, and social and business networks.	R. Boix and V. Galletto, 2009
	Production specialisation, network organisation, trust relations, collective learning, circulation of knowledge and technologies, diffuse entrepreneurship, spirit of emulation, quality, flexibility and mobility of human resources, education, strong domestic competition, and co-penetration between the economy and society in local cultures founded on centuries-long traditions.	F.Pyke *et al.* 1990; F.Pyke and W. Sengenberger 1992; F.Cossentino *et al.* 1996; G.Becattini *et al.* 2003; G.Becattini 2004.

Source: the authors's presented major factor groups based on A.Marshall 1890; Bostic *et al.* 1997; Piore and Sabel 1984, etc

The Third Industrial Revolution (hereinafter TIR) began in the last half of the 1950s, with the sudden explosion of U.S. corporations beyond national and continental limits, (Hazen 1969) placed emphasis on more sophisticated cooperation between government and industrial structure. During the TIR, the development of industrial clusters led to new forms of interaction, not only among companies, but also between public institutions and countries. After TIR, industrial clusters have started to play a significant role in the development of not only states but also the entire global economy (Ignatavičius *et al.*2015; Tvaronavičienė *et. al.* 2015; Travkina, Tvaronavičienė 2015; Tvaronavičienė, Černevičiūtė 2015; Rezk *et. al.* 2015). Many economists consider the process of industrialisation as the main factor for the development of the company (Cameron 1961; Gerschenkron 1962, Hobsbawm 1962; Mitchell 1976; Landes 1969; Kemp 1969; Rostow 1971; Cafagna 1971; Baer 1964).

All these revolutionary approaches have led to significant changes in the direction of development of the World`s economy and has become a significant factor that must be constantly considered in determining the newest trends. Industrialisation major factor groups could be seen on Table 4.

Table 4. Industrializaion major factors groups that influenced world economy transformation during TIR

Factors groups	Impact Description	Author
R&D (Scientific industrial districts)	Industrial zones help regional development in upgrading research technology.	D.Keeble 1989
	Variations across sectors and over time depend upon a number of factors related to the opportunities to develop an appropriate technology.	M.Robson and R.Rothwell 1985
	In industrial districts (scientific industrial districts), had a key role in the country or in the world for supporting the influences of R&D expenditures.	W.Koh *et.al.* 2005, Jin-Li Hu *et.al.* 2010
	Technology adoption is a critical factor in national competitive performance as part of national capabilities in Industrial Technology.	D. Mowery and D. Teece 1993
	Benefits of industrialisation is stated in the concept of the "big push"; various sectors of the economy adopted increasing returns technologies simultaneously; they could each create income that becomes a source of demand for goods in other sectors.	N.Paul 1943, R.Nurkse 1953, T.Scitovsky 1954, and J.Fleming 1955
	Industries with a high degree of industrialisation are more successful in their development.	J. Kurth 1979 D.Leighton 1969
	The global reorganisation of manufacturing, which is referred to as the new international division of labor, is considered by some to be the defining characteristic of the latest wave of globalisation.	F.Frobel *et.al.* 1980; M.Castells 1996; A.Hoogvelt 1997 Gereffi G. 1995, 2005
	Economic exchanges between relatively independent parties have been replaced by complex and highly interdependent systems of industrial production and economic exchange organised on a global scale.	P.Dickens 2003; Gereffi 1994,

Multinational development	Transition from a "traditional" (rural, backward, agricultural) society to a "modern" (urban, industrial) society directly links the concept of development with industrialisation theory.	C. Gore 1996
	Economic growth strategies were emphasised on similarities and dissimilarities in the attitudes taken toward participation in the international division of labor.	B.Balassa 1970
	Countries that have reached this stage have been alternatively described as "semi-industrial" or "newly industrialised".	J. Bergsman 1979
	The structural transformation as part of development strategy for developing countries with industrial development as a core idea. Associated with state assistance for declining industries in developing country which could not compete.	V. Rosenbiaum *et.al.* 1985
	Industrial development associated with a supposed 'imperative' towards innovation. Innovation takes place in terms both of product improvement and of process design.	E.Mansfield 1968; R.Rothwell and W.Zegveld 1982; R.Vernon, 1966

Source: the authors presented major factor groups based on Keeble, 1989; W.Koh *et.al.* 2005; Mowery and Teece 1993; Kurth 1979 and etc.

4. Industrialisation and post-industrial society

Modernisation theorists argued industrialisation impact that created modern economies. In the later stages of economic development, 'the demand for manufacturing also decreases while the demand for services increases' (Levy 1966). This shifts employment from manufacturing to services. Analysis on postmodern based on Table 5 shows the dramatic changes from industrial to post-industrial modes of production. The authors's goal is to integrate post-industrial realities into modern industrialisation concept, representing the new economic paradigm in the modern concept of industrialisation. The authors point that, in order to be successful in nowadays markets these tendencies bring us towards the understanding that modern industrialisation concept lacks postindustrial society context analysis (detailed info on Postindustrial society is described in Table 5).

Table 5. Comparison of the characteristics of the industrial and information (post-industrial) society

	Industrial society	Information society (Postindustrial)
Core	Steam engine (power)	Computer (memory, computation, control)
Basic function	Replacement, amplification of physical labour	Replacement, amplification of mental labour
Productive power	Material productive power (increase in per capita production)	Information productive power (increase optimal action-selection of capabilities)
Products	Useful goods and services	Information, technology
Production centre	Modern factory (machinery, equipment)	Information utility (information networks, data banks)
Market	New world, colonies, consumer purchasing power	Increase in knowledge frontiers, information space
Leading industries	Manufacturing industries (machinery industry, chemical industry)	Intellectual industries, (information industry, knowledge industry)
Industrial structure	Primary, secondary, tertiary industries	Matrix industrial structure (primary, secondary, tertiary, quaternary/systems industries)
Economic structure	Commodity economy (division of labour, separation of production and consumption)	Synergetic economy (joint production and shared utilisation)
Socio-economic principle	Law of price (equilibrium of supply and demand)	Law of goals (principle of synergetic feed forward)
Socio-economic subject	Enterprise (private enterprise, public enterprise, third sector)	Voluntary communities (local and informational communities)
Socio-economic system	Private ownership of capital, free competition, profit maximisation	Infrastructure principle of synergy, precedence of social benefit
Form of society	Class society (centralised power, classes, control)	Functional society (multicenter, function, autonomy)
National goal	GNW (gross national welfare)	GNS (gross national satisfaction)
Form of government	Parliamentary democracy	Participatory democracy
Force of social change	Labour movements, strikes	Citizens' movements, litigation
Social problems	Unemployment, war, fascism	Future shock, terror, invasion of pri- vacy

Most advanced stage	High mass consumption	High mass knowledge creation
Value standards	Material values (satisfaction of physiological needs)	Time-value (satisfaction of goal achievement needs)
Ethical standards	Fundamental human rights, humanity	Self-discipline, social contribution
Spirit of the times	Renaissance (human liberation)	Globalize (symbiosis of man and nature)

Source: Masuda 1980

As a result, nowadays performance depends not only on the production processes; therefore, new performance expressions are considered both on strategic level and decision levels (strategic, tactical and operational). Thus, knowledge in performance expressions of the modern company must be considered from top to bottom for all the activities or processes to be controlled (Bititci 1995; Rangone 1996; Ghalayini *et.al.* 1997; Suwignjo *et.al.* 2000). In the information age, effective use of intellectual capital is the most important factor in the success or failure of a business (Goh 2005). Scientists (Eustace 2001; Upton 2001; Lev 2000; Beattie and Pratt 2001; Ignatavičius *et al.*2015; Tvaronavičienė *et. al.* 2015; Travkina, Tvaronavičienė 2015; Tvaronavičienė, Černevičiūtė 2015; Rezk *et. al.* 2015) have confirmed that demand for knowledge-based resources is growing as companies increasingly base their competitive strength in the value of know-how, patents, skilled employees and other intangibles. The advance of modern Information Communication Technologies (ICT) has launched the Industry 4.0, which is the German newest strategic initiative to take up a leader role in industrial IT which is currently revolutionizing the manufacturing engineering sector (Beattie and Pratt, 2001). Industry 4.0's strategy will allow to stay a globally competitive with the industrialisation factors discussed from the first, second and third industrial revolution. Technology breakthrough allowed to increase the level of automation and production and labor cost decreased. Commentators use the term "industry 4.0" to refer to a fourth industrial revolution with four main characteristics (Industrie 4.0., 2014) The fourth industrial revolution is more focused on intangible assets (associated with IC) managing company data flow, plant-specific software and the "hardware" of manufacturing technology (industrialisation factors). Since ICT is only one part of the Industry 4.0, the other is its use of industrialisation factors and the utilisation of the benefits that it brings to the value chain (Figure 2). "Industry 4.0" (sometime referred as Smart industry) advantages are coming from the technological evolution - from embedded systems to cyber-physical systems (Figure 2).

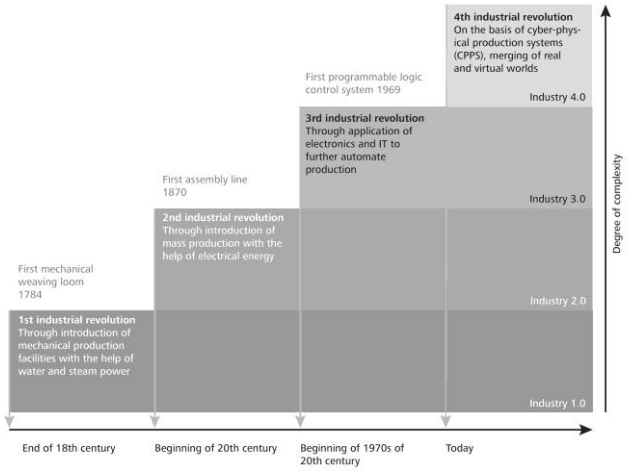


Figure 2. The evolution of embedded systems into the Internet of things, data and services

Source: Acatech 2012

Cyber-physical systems intelligence helps create intelligent object networking and independent process management, with the interaction of the real and virtual worlds representing a significant new aspect of the manufacturing and production process integration. Industry 4.0 creates networked production, in which orders managed automatically throughout entire value chains, order processing machines and material and organize their delivery to the customer (Schlick, Stephan and Zühlke 2012). Cyber-physical systems provide the basis for using these data efficiently. This is a considerable competitive advantage (reducing downtimes, accurate planning, reducing unit costs and etc.) - the creation of an Internet of Things, which combines with the Internet of Services to make Industry 4.0 symbiosis possible. After considering the main events and stages of development of industrialisation, the authors make the system of industrial production in order to recognize

competitive factor for manufacturing company. To make it transpicuous, the authors propose to use the following scheme of evolutionary processes in the theory of industrialisation (see Figure 3).

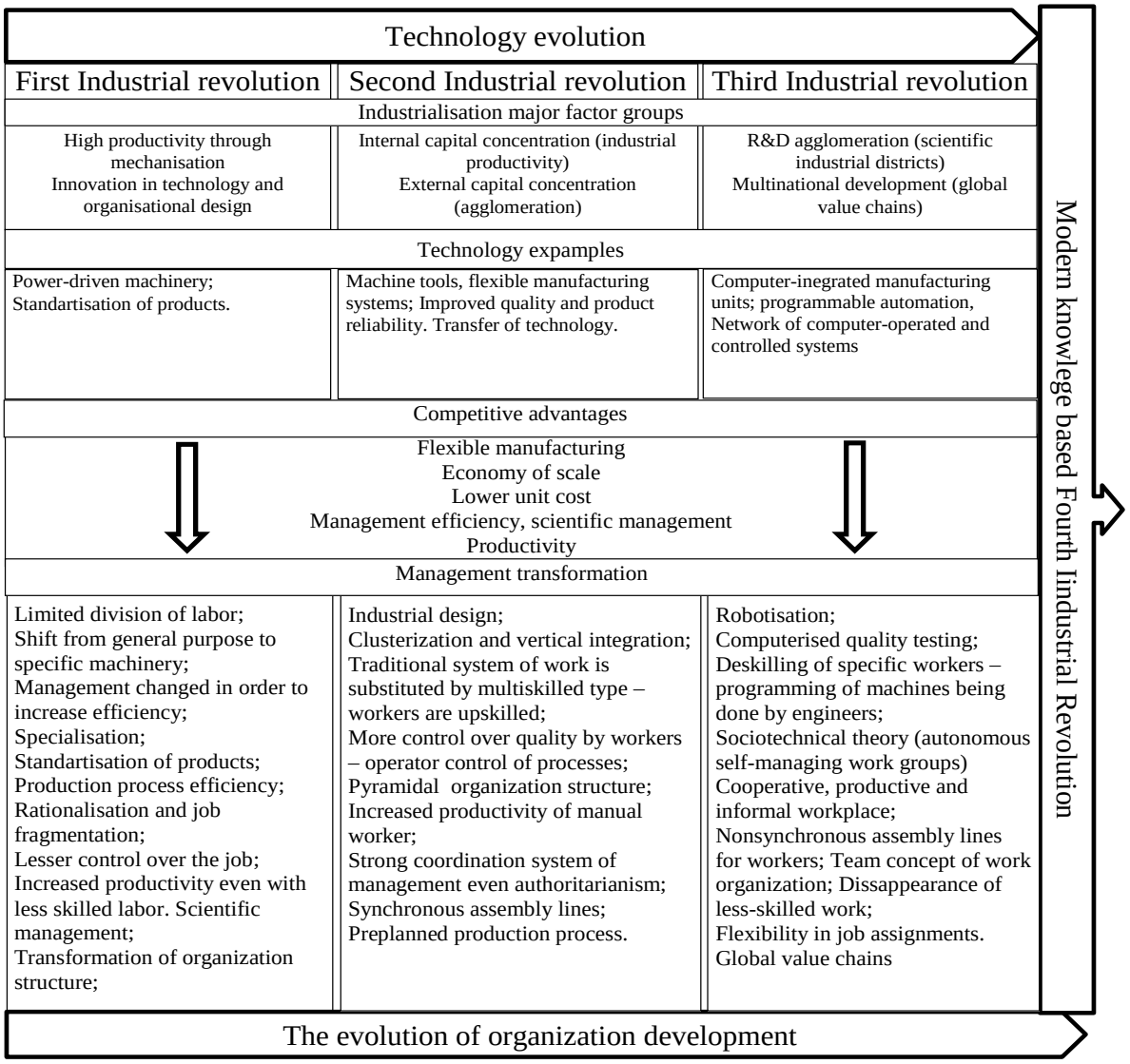


Figure 3. Evolution of industrialisation system and industrialisation factors

Source: the authors's presented model using Berger 2014; Helfgott 1986 … etc.

The authors, based on above-mentioned numerous studies, suggests his own development model of industrialisation factors. By the authors' opinion – "superimposing" is the most appropriate method to integrate industrialisation factors into post-industrial society. Nowadays, in post-industrial society paradigm traditional manufacturing industry is digitally transformed by exponentially growing technologies (e.g. intelligent robots, autonomous drones, sensors, 3D printing). Manufacturing companies and their industrial processes are adapting to the adjustments in values. The digital computer in the 1950s and the integrated circuit in the 1970s were two inventions that steered the manufacturing technology onto a new shift. Before, only the material-processing system was improved. With the computer age, industrialisation was "superimposed" to the information-processing system in the rationalisation and improvement work. While the mechanisation is best suited for large-scale production, the information-processing system can in general be applied to all manufacturing activities. With the help of the information-processing system machines were equipped with digital control units, systems started to be integrated with each other by a central computer (Hoppe and Berv 1967).

New microelectronic components, especially the microprocessor, came and formed the basis of the powerful and cost-effective control systems of today (Karlsson 1991). These trends started with a greater level of production automation, a process that has, since the 1970s, been driven by developments in electronics and information technology. Computer-aided design (CAD), robots, numerical control (NC) machine tools,

flexible manufacturing systems (FMS), and other programmable automation equipment and systems are supplied by industries that are currently more or less separate. Numerical control (NC) is the oldest and largest, dating from the 1950's (Hunt 1983). While significant markets for CAD and robots did not emerge until the 1970's (Kurlak 1982). In the early 1980s industrial robots were seen as the ultimate solution to automatized factories. The productivity also relies on many factors that interact with each other, and therefore 'the robots alone cannot improve the productivity, a robot is the ultimate mechatronic system' (Westerlund 2000). New industrial development have increasingly embraced modern ICT, manufacturing industry around the world now integrates ICT creating new approaches to development, production and the entire logistics chain.

Links to both business and social networks – the business web and the social web play an important role in the digital transformation to industry 4.0. Smart network of machines, properties, ICT systems, smart products and individuals across the entire value chain and the full product life cycle establish new environment (Figure 4). Smart Factories continually share information about current stock levels, problems or faults, and changes in orders or demand levels. The widespread adoption by manufacturing industry and traditional production operations of ICT is increasingly blurring the boundaries (Spong, Hutchinson and Vidyasagar, 2006) between the real world and the virtual world in what are known as cyber-physical production systems (CPPSs).
Processes and deadlines are coordinated with the aim of boosting efficiency and optimising throughput times, capacity utilisation and quality in development, production, marketing and purchasing. CPPSs not only network machines with each other, they also create a new environment (Figure 4).

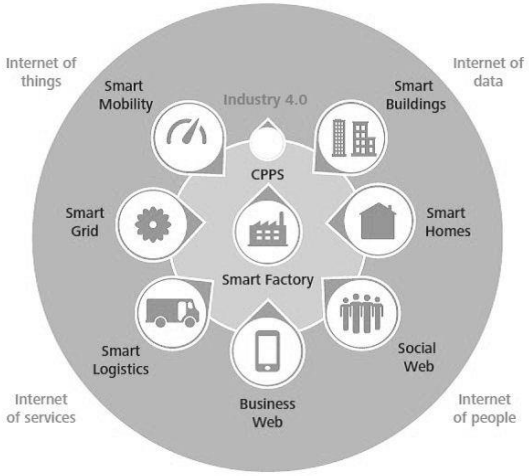


Figure 4. The industry 4.0 environment

Source: D. Schatsky 2013; DFKI 2013

Industry 4.0 cornerstone is its interface with other smart infrastructures (e.g. smartmobility, the smart grid, smart logistics and smart homes and buildings). All these new networks and interfaces offered by industry 4.0 within an 'internet of things, services, data and people' mean that manufacturing is set to implement considerable changes in future. Traditional industrial society expected to implement this fourth industrial revolution, increasing global competitiveness. This means that industrial production machinery no longer simply "processes" the product, but that the product communicates with the machinery to tell it exactly what to do. Connecting embedded system production technologies and smart production processes creates new technological age advantages, which will radically transform industry and production value chains and business models (e.g. "Smart Factory").

5. Survey and results

Empirical research based on theoretical findings was performed from July 2013 until September 2014. The population of the survey was – 8 981 enterprises of Latvian manufacturing companies working in manufacturing industry. The number of respondents surveyed (368 surveyed online) compared to the number of companies reflected in the database made up 4.09% (5.00 confidence interval).
During industrialisation factor analysis, the research authors constructed the questionnaire with the number of variables determined by the context of the research. Quantitative data processing was performed with SPSS program, descriptive and conclusive statistical methods in data processing were used. Research results revealed industrialisation diffusion problems for SME (use of industrialisation advantages). The calculation of the SME industrialisation diffusion is performed by using formula (1):

$$IndDistr = \frac{\bar{R}}{\overline{Impl}} \qquad (1)$$

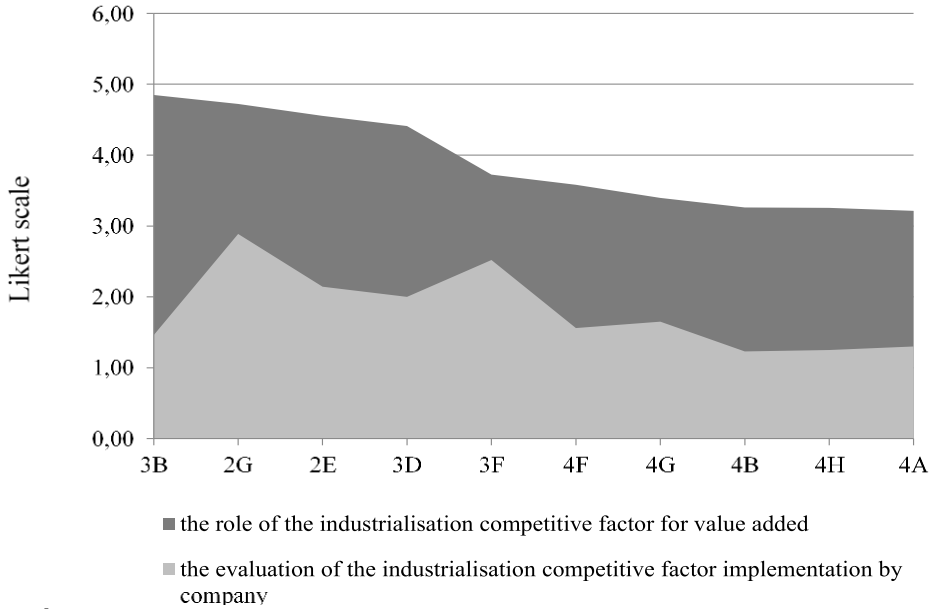
IndDistr - the distribution assessment of industrialisation factors among SMEs in manufacturing industry;

$\overline{Impl} = \frac{\sum_{i=1}^{n} Impl_i}{n}$ - the average evaluation of the industrialisation factors implementation by the company, using 6 point Likert scale;

$\bar{R} = \frac{\sum_{i=1}^{n} R_i}{n}$ - the average role of the industrialisation factor for value added, using 6 point Likert scale.

The result of the companies' industrialization factors` significance is shown in Figure 5.

Based on results SMEs still highly evaluate industrialisation factors, but could not take full advantages of them. Exploiting economies of scale and transactional cost factors will significantly reduce operation cost and increase profit margin. Currently Latvian SMEs are exploiting operations management and flexible manufacturing system. In case of SMEs, associations and Industrial Parks could provide necessary transactional cost reduction.



3B Vertical integration system
2G Mass production
2E Production process continuity
3D Automated and synchronised manufacturing system

3F Patents and intellectual systems
4F Special financial instruments through the Association and Industrial Park
4G Additional export capabilities through the Association and Industrial Park
4B Suppliers and transport transaction cost reduction, reducing the cost of using resources and logistics through the Association and Industrial Park
4A R&D capabilities through the Association and Industrial Park

Figure 5. Evaluation of the top 10 factors and its support by Latvian manufacturing companies

Source: survey data analysis

The authors conclude that implementation of industrialisation factors is insufficient to create high value added products for SMEs (30 % - average industrialisation factors' implementation by companies for top ten valued factors) Figure 5.

6. Conclusions

The discussed above results allow concluding that conventional industrialisation development is no longer dominant in modern economy. For the purposes of the modern industrialisation approach, information and knowledge-based perspectives are useful in understanding the structural changes associated with the industrialisation transition into post-industrialism. New relationships with customers, the integration of information and knowledge-based perspectives and organization development theory in dynamic environment to the context of industrialisation are the relevant and problematic issues of management science. The solution of them could expand the field of management research and could fill the gaps of scientific discussion on the topic.

In this paper, our main goal was to reveal the challenges for modern industrialisation concept concerning the post-industrial society approach. The authors use "superimposing" method to explain industrialisation transformation process to the modern post-industrial value creation process. The authors see it as the most appropriate method to integrate industrialisation factors into post-industrial society, in order to correspond to the economic transformation into post-industrial.

With the information age industrialization factors were "superimposed" to the information-processing system in the rationalisation and improvement work.

The demand for knowledge-based resources and advance of modern ICT will exploit the Industry 4.0, newest strategic initiative focused on intangible assets. Traditional industrialization environment expected to transform into fourth industrial revolution advantages, across the entire value chain and the full product life cycle integrating into new environment.

Acknowledgments

The paper was supported by the project «The Development of Innovation and Entrepreneurship in Latvia in Compliance with the Smart Specialization Strategy» within the National Research Program 5.2. «Economic Transformation, Smart Growth, Governance and Legal Framework for the State and Society for Sustainable Development - a New Approach to the Creation of a Sustainable Learning Community (EKOSOC-LV)»

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