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Evaluation of Iran Architecture Knowledge on Industrial Complexes
In Order to Discover the Challenges and Provide Developmental Strategies

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Abstract
The present paper has notified that the evaluation of architecture knowledge for industrial complexes helps identifying its development challenges. Thinking about the components of architecture knowledge development caused the evaluation to be occured in three sections of theoretical knowledge (or theoretical productions), knowledge transition (or training programs), and practical knowledge. Since the nature of the mentioned triad was different, the evaluation method of each was chosen in relation to their substantial features. As a result, evaluation of theoretical areas, due to its written nature, is accompanied by content analysis method. In this section, scientific research-based articles (published in fifteen authentic architecture journals, until winter 2014), 2500 selected books, M. A. theses (conducted from 2001 to 2010 in University of Shahid Beheshti), and Ph. D. dissertations (completed in domestic universities until 2012) were studied to estimate the quantity of production knowledge in terms of the architecture of industrial complexes. It is noteworthy that this evaluation took place compared to six selected functions i.e. landscape, residential, religious, healthcare, educational, and administrative. In transitive knowledge section, the mentioned evaluation was dedicated to the analysis of programs' contents, orientations, fields of study, and courses, presented in three levels of BA, M. A., and Ph. D.. Furthermore, in order to know about the status of practical knowledge, the orientation of architecture competitions (including periodical competitions and those, taken part from 2007 to 2009) were evaluated. Also selected samples of the existing industrial units (i.e. 63 industrial units in Caspian Industrial Park, Qazvin) were studied. Results showed that architecture knowledge of industrial complexes, compared to other functions, had the least theoretical production as well as transitive training (quantitative challenge). Despite such circumstances, in the practical area it enjoyed some quantitative growth and requires qualitative attention (qualitative challenge). What is more, the development of architecture knowledge in terms of industrial complexes lacks any coherent structure, chiefly growing in a local and discrete manner. Results showed that the mentioned challenges are dealt with by integrating the mentioned triad and adopting practice-to-theory strategies (as reverse engineering). The research has emphasized that developing architecture knowledge for industrial complexes can be done by programming as a matrix of supplementary and evolutionary components, comprising the triple areas.

Keywords
Architecture, industrial complexes, knowledge development, theoretical knowledge, knowledge transition, practical knowledge

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Introduction

Human habitats have always included various human activities, which resulted in a kind of spatial requirements that are distinguished chiefly with spatial or functional titles (such as residential, educational, religious etc. Industrial function defines a set of activities or spatial requirements that involve a large spectrum of industrial spaces, units, facilities, parks and areas, clusters, and other centers. Paying close attention to lexical meanings show that industry is in line with production or services (Porter, 2005: 43). On the other hand, the given definitions by researchers of this field confirm that industrial buildings serve mechanical manufacture of the goods or products either directly or indirecty (Coup et al., 2001: 11 & SCI, 2008:2). What was mentioned above shows that the quantitative expansion and vastness is one of the important features of industrial complexes. Considering the quantitative dimension of industrial complexes on one hand, and their vial role in economic, political, security, etc. development of the country, on the other, confirms its special position in varied programming. Programming for the development of architecture knowledge for such vast and vital complexes is one of the dimensions of macro-planning; nonetheless, preparing each developmental program requires knowledge of the current scales, based on what the future horizon could be drawn. Thus the present paper intends to first discover the probable challenges, in the field of architecture knowledge of Iran industrial complexes, then to draw the way of programming to develop this knowledge. Hence the present paper tries to answer the following questions:

• What are the most important challenges of Iran architecture knowledge, concerning industrial complexes?

• Which field(s), component(s), and guideline(s) does the priority of this knowledge development programs emphasize?

Moreover, with regards to both above questions, the following hypotheses are made:

• Development of Iran architecture knowledge, concerning industrial complexes, encounters local and discrete growth challenges, as well as the quantitative ones, existing in its different sections such as theoretical knowledge, knowledge transition, etc.

• To remove such local growth, dominant over the mentioned knowledge, one is required to make programs of development components in a matrix form. What is more, facing theoretical and transitive challenges requires much attention in the existing practical knowledge, realizing in a road from practice to theory (with a reverse engineering guideline). Along with such a guideline, one can utilize other grown sections as a cathalist.

The conceptual structure of the present paper can be divided into three general parts. In the first one, under the title of Theoretical Framework, the position of evaluation in components of architecture knowledge development will be explained and the significant indices for science evaluation will be introduced. The second part evaluates the current circumstances of this knowledge, relative to development components. And finally the part, entitled Conclusion, scrutinizes the challenges and guidelines of development of this knowledge.

Theoretical Framework

Evaluation of architecture knowledge requires scrutinizing two essential subjects. On one hand, the vast expansion of architecture knowledge needs classification of different areas so that based on the nature of each class, the current circumstances could be analyzed. On the other hand, evaluation, itself, requires appropriate indices for assessment. Thus, the theoretical bases of this research step in two different ways. In the first step it explains various fields of architecture knowledge, their relations, and position of evaluation in harmonious development of this knowledge and in the second step, the bases of selecting science indicators are presented.

A. The Importance of Evaluation in Chained and Harmonious Development of Architecture Knowledge

In the history of thought (different sciences such as philosophy, ethics, politics, wisdom, etc.) the relation between a theory and practice was considered as a contemplative issue. Several viewpoints have tried to find the precedence or subsequence of these fields. The theory-oriented viewpoint of Plato, ahead of all attempts, gave theoretical world more value. Unlike Plato, Aristotle's teleological viewpoint pays more attention to practice and practical dimensions of thought. According to Aristotle, the ability of using knowledge is far more important than knowledge, itself; therefore, the importance and position of theoretical area depends on its operation (Masoudnia, et al, 2012: 130-132). Such a dispute in the opinions of Mollasadra and Imam Mohammad Qazali leads into the precedence of theory (Asadi, 2008: 23; Shabani, 2010: 44-50). It is noteworthy that the precedence of theory over practice in different individuals' opinions and in other sciences has led to varied results, yet regardless of he precedence of either theory or practice, their cohesion in different sciences is considered as a presupposition, which is true in the field of architecture too. One can claim with certainty that the science of architecture like other sciences is a composition of theory and practice, which begins from the mental roots and proceeds towards being realized in examples (Noqrehkar, 2010: 3-10). The movement of architecture from theoretical roots (ultimate causes) towards realization (formal cause/effect) is an effective movement that results in the product (Islami, 2001: 48, 49). Therefore, such a process can be regarded as a complementary dimention of architecture that results in formal product or establishing preferred conditions (Nadimi, 2012: 7; Gero, 2006: 27; Simon, 1969). The fulfillment of architecture in this level is simultaneous with finishing a project (realization of the action) and starting the next ones. In other words, each project at the end of its fulfillment road is linked with the beginning of future projects. The tool, linking these projects, giving their movement a spiraling path, is nothing other than the evaluation of experiences. In this case, criticism or evaluation of the taken paths (whether in theoretical or practical areas) helps correcting the directions, orientations, beliefs, needs, etc. (Moore, 1979a, 21 & 1979b, 52; Castro , et al, 2012: 140). Therefore, evaluation becomes the connecting ring in the sequence of theoretical-practical continuum and by generating the required motivations for progressive movements, causes the evolutionary path of architecture. It can be understood of what is just said that development of architecture knowledge depends on the following two things:

1. Formation of a continuum of theory towards practice that produces complementary component of architecture. It moves on the surface, having no other purpose than the product.
2. Evaluation of theoretical and practical areas, i.e. getting to know the details of previous researches, scientific activities, existing challenges, weakness, requirements, etc. which paves the way towards the evolution of architecture. Unlike the complementary component, this one is progressive, aiming to develop the products. As the continuum of theory-practice links with the other continuum, evaluation in this position creates the setting for the formation of spiral chain. Thus the theory could be considered precedent to practice and practice, precedent to theory. Another fact, worthy of note, is that thinkers such as Pooper define evaluation and criticism as the essence of scientific advances, etc. This confirms their valuable position in knowledge development.

Apart from the cohesion of theoretical and practical fields as a result of evaluation, they interconnect in another way: the transitive area, which becomes responsible to transfer the findings of theoretical area to the practical one. In the modern world this responsibility is born by educational systems and their methods (Hojjat, 2010: 24). Hence in the path of architecture knowledge development, the three theoretical, transitive, and practical areas are intertwined as an expansion in line with two complementary and evolutionary components. In this cohesive system, the theoretical area produces

the mental knowledge, the transitive one teaches the findings, and finally the practical one uses them. In simpler terms, the integrity of the three areas is to produce theoretical discussion, transfer, and use them in a continuous and cohesive flow, proclaiming the favorable development of architecture knowledge. Obviously, no formation of cohesive relation among these components can result on the local and discrete growths in differing parts of knowledge on one hand and affect the quantitative and qualitative dimensions of knowledge development on the other.

A. Scientometrics and Evaluation Indicators

Contemplating about the nature of science has been on along philosophical endeavors, having several viewpoints. Nonetheless, the scientific revival in the modern era started the life of sciences as well as modern viewpoints to its existential dimensions. Simultaneous with such an evolution, known as scientific revolution, many fields of science such as physics, chemistry, biology, etc. commenced in a new setting, studying different realities (Akasha, 2008: 3-21). Scientific revival, which was formed based on refining science from non-science, turned science into its subject matter within its evolutionary road. Both the philosophy of science (posing issues such as epistemology of science, epsitomology of the tools, techniques, and methods, producing it, the the limits of understanding, the structure of hypotheses and theorires, etc.) and the sociology of science (theoretizing about the relations of science space with social space) tried to clarify some parts of science features (Movahhed Abtahi, 2011: 126; Tavakkol, 2010: 24-25). Subjectivity of science, one of the defining traits of the above fields of study, is also pursued in sciencometrics. In this case, sciencometrics, sociology, and philosophy of science act as two-component devices of science dimensions, bringing up relevant issues. As this device's first schema shows sciencometrics deals with quantitative relation of texts and institutions (Fig. 1). It is noteworthy that statistical analysis of scientific texts began from the first quarter of twentieth century and in its path of development reached other secondary branches such as bibliometrics, webometrics, etc., each trying to assess the different examples of science production (Brown, et al. 1995: 71). Sciencometrics is a functional method to identify and evaluate scientific productions of countries, individuals, and organizations; thus in order to evaluate scientific activities and their efficiency rate, it counts the number of scientific productions in different areas, then to analyze them by means of relevant indicators (Hood & Wilson, 2001: 293-295; Hess, 1997: 75). Some of sciencometrics and bibliometrics' goals are to establish systems of research-describing indicators. Science and technology indicators are a set of measurable data that describe the scientific status of an individual, group, institution, or country. Such indicators are important when each instituition adopts executive policies and strategies, and can be used as a reference for programming towards a favorable scientific status. productivity indicators (including the number of articles in relation to the research background, the proportion of articles to the number of researchers, the number of publishment in better journals, etc.), impact indicators (such as the number of citations, the proportion of citations to the number of articles, etc.), and hybrid indicators (such as indicator h, indicator g, etc.) are three general groups of common criteria when assessing scientific productions (Yazdani, et al, 2014: 80). Nonetheless, such indicators are mostly used to assess scientific articles and cannot be used in the measurement of other scientific productons such as functional researches, international discovery, book, global scientific task forces resulting in articles, journals indexed in authentic international centers, production of uniques scientific and artistic works, entrepreneurship and innovation, production of universal literary works, etc. (Norouz Zadeh & Rezaei, 2009: 19). In order to remove such an issue, some national and international institutions present the indicators, considerd for evaluating scientific productions. UNESCO, OECD (Organization for Economic Co-operation and Development), Economic ans Social Comission for Asia and the Pacific, etc. are some international

institutions, defining authentic indicators for evaluation of scientific activities (Maztarzadeh, 2000: 2-6). Comparison of these indicators shows that the quantity of publishment is one of the easiest indicators of scientific evaluation, which can be expanded to other productions. Hence in the present article the quantity of publishment for evaluation of scientific productions such as research-based scientific articles, Ph. D. dissertations, and M. A. theses were selected in theoretical area. On the other hand, in order to move evaluation indicator closer in all three areas, abovementioned, it was attempted to equalize the quantity indicator in relation to the considered area. Therefore, the quantity of courses in the syllabus was set as the criteria for educational programs, orientations, and fields of study in training field. What is more, the subject quantity for architecture competitions as well as the quantity of innovative designs for industrial executed projects was selected in the practical one.

What was told previously emphasizes that harmonious development of architecture knowledge requires comprehensive development of three fields of knowledge production, knowledge transfer, and its usage. Development of these areas depends on evaluation and criticism, which aims for evolutionary development path, on one hand, and needs movement towards the realization of theoretical subjects, on the other. Meanwhile, both evaluation and the mentioned role can be effective to determine the challenges. Evaluation of tripartite knowledges requires having some indicators and the indicator of production quantity as one of the indicators of sciencometrics (along with its expansions) could be used for measurement and evaluation.

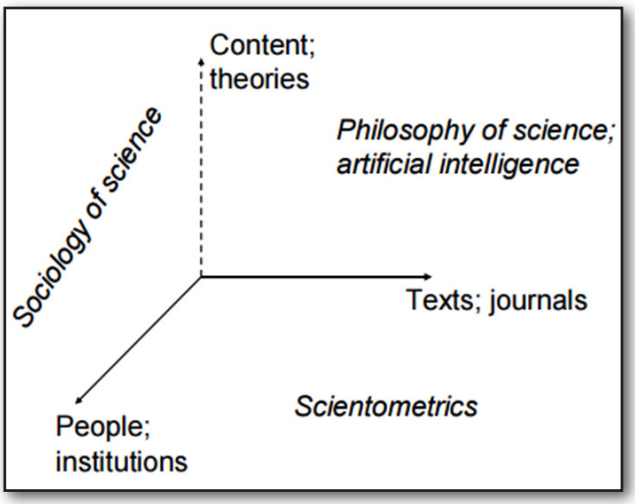


Fig. 1. Schema of interrelated dimentions of science.
Source: Leydesdorff & Milojević, 1995: 5.

Research Background

Evaluation of different areas of knowledge in order to know the challenges, strengths, weaknesses, advantages, etc. is common in various sciences such as architecture. In theoretical area, Razjouyan, et al. (2001) classified the papers, included in Soffeh Journal, for ten years. Bemanian, et al. (2008; 2013) as two separate reseach-based activities evaluated the articles of Honar-ha-ye-Ziba and Modiriyatshahri quantitatively and qualitatively. In the area of M. A. theses, Qodousi far (2008) conducted a research to have a thematic study of architecture theses in the faculty of fine arts. Moreover, documental review of Ph. D. dissertations of architecture and urban planning of the University of Tehran, done by Ahmadzadeh (2005) is another example of similar activities. The contents of the thematic and the number of writers, scientific ranking of the origina author, his/her organization dependency, the source of deriving the paper, methodology and acceptance time period, citations, etc. are the most important things to be measured in the mentioned activities. It should be said that all these researches have been carried out in terms of theoretical product evaluation. In the transitive area, Islami and Qodousi (2013) analyzed and evaluated the current scales of educational system for architecture in Iran in a qualitative research, believing that based on Islamic world view the current educational system could be given an appropriate structure. Moreover, Kiani (2010) explained the necessity of developing and expanding interior design in B. A. level. In another research, Husseini, et al. (2008) explained the tools and barriers of sustainable architecture in Iran. Absence of job market in the practical area is one of the things they claim as a barrier to motivate the students towards

sustainable topics. In practical area there are many research-based activities in terms of evaluation or criticism of architectural works, in accordance with the time and space. Apart from existing similarities and differences among previous researches, all of them are limited to a theoretical, educational, or practical area, pursuing a detailed approach, the adoption of which in such researches prevents the evaluation and understanding of the compensated items in other areas. Thus the present research tries to simultaneously evaluate all theoretical (or production of theories), transitive (or training), and practical (application of the findings), which is by itself the most important aspect of innovation in the present research. What is more, the current paper evaluates the abovementioned three areas, centering on industrial complexes, which essentially differs from the mentioned researches, being its second innovative aspect. These circumstances cause the present research to make much distance from the abovementioned historical background, inhibiting the possibility of their comparison to a large extent.

Methodology

Since the proposed evaluation of this paper occurs on three sections of theoretical, transitive, and practical knowledge, methodology and statistical population of each part has been selected with regards to their natural features. When evaluating the theoretical knowledge, which involves four written areas of scientific, research-based articles, books, theses, and Ph. D. dissertations, due to its written nature, content analysis method has been used. Moreover, the four different circumstances of theoretical area prevented a similar statistical population; therefore, the statistical population was considered for them independently, considering their specific conditions. Obviously, since comparison of the productions is taken into consideration in seven chiefly-separet usages, an independent statistical population does not affect the total topic. Based on the statistics, published by Iranian Commision of Scientific Journals, until mid-March 2013, a sum of sixteen architecture and urban-planning journals had been active in the country with a scientific, research-based certificate. One of these journals was in English which was removed from the statistical population; therefore, all Persian articles, included in fifteen scientific and research-based architecture journals, which had been published until winter 2013, were analyzed. It should be said that the articles in two journals of Honar-ha-ye-Ziba as well as Housing and Rural Environment, do not include all of the published versions, as a result of the changes in their titles. Furthermore, in terms of book analyses, 2500 architecture books, presented in one of the most important specific book centers made the statistical population of this area. The great number of M. A. theses of architecture and unavailability to all of them caused the statistical population of this area to be limited to a ten-year period in Shahid Beheshti University. Such a time limit was from 2001 to (the end of) 2010, involving 470 theses. Evaluation of Ph. D. dissertations has also been devoted to desertations, completed in six important universities of the country, i.e. University of Tehran, Shahid Beheshti University, Iran University of Science and Technology, Islamic Azad University (Science and Research Branch), Tarbiat Modarres University, and Tabriz Islamic Art University (until 2012). Content analysis of these productions, mostly deals with a thematic analysis so that it can determine the quantity of knowledge production in terms of industrial complexes. Furthermore, in order to make tangible the rate of theoretical production publishments concerning industrial complexes, this evaluation was performed compared to six selected functions i.e. landscape, residential, religious, healthcare, educational, and administrative. It is noteworthy that in order to increase the research validity, after surveying the experts a list of main keywords was prepared for each function so that the texts would be assessed in accordance to them (Table 1). The mentioned texts were then reviewed carefully and thematically classified as prepared sheets for each function. Next, the completed sheets were inserted into Excell and the required statistics were

extracted from this software. In order to ascertain the research reliability, the thematic classification of the articles was done by another person independently. In terms of evaluating transitive section, which deals with schedules, courses, orientations, and fields of study, the content analysis was employed. This research covered three levels of B. A., M. A., and Ph. D. and similar to the theoretical area, they were analyzed in comparison to six selected functions. The analysis was also done based on the subjectivity of the selected functions in the curricula. In order to know about the status of practical knowledge, the practical activities in this field were evaluated. These activities include the designs, prepared as competitions or executive designs by expert circles of the country. Hence in order to evaluate the orientation of architecture competitions, both the known periodical prizes and competitions, which had taken place from 2007 to 2010, were given account. Evaluation of executive projects also happened as a review of selected samples from the industrial units in industrial parks of Qazvin Province. It is noteworthy that these analytical samples covered 63 industrial units of Caspian Industrial Park in Qazvin. Since in the practical section the industrial complexes had a significant quantity, another used indicator is the quantity of innovative industrial designs.

Analysis of Three Thoretical, Transitive, and Practical Areas

As mentioned above, for thematic analysis of different texts, such as scientific and research-based articles, Ph. D. dissertations, and M. A. theses the prepared keywords were used for seven selected functions. Accordingly, scientific and research-based articles were measured in their own statistical population, which included 2436 articles, as seven selected functions. Hence the number and percentage of the articles was determined for each journal. It should be said that all articles, written outside the mentioned functions, fell under the group of "others". Summing up the scientific and research-based articles in fifteen architecture journals of Iran shows that industrial fuction, having twenty papers out of all reviewed articles, gets the fifth rank of researches among abovementioned functions. Later on, the same process was used to determine the quantity of related books with the selected functions. After reviewing 2500 selected books among written or translated architecture books, it was revealed that only 11 books deal with industrial complexes. These results show that published books in industrial complexes were much fewer than other functions. Thematic study of M. A. theses of architecture in Shahid Beheshti University (from 2001 to the end of 2010) indicate that from 470 reviewed theses, the share of educational, residential, administrative, healthcare, religious, industrial, and landscape functions are 49, 32, 23, 23, 12, 4, and 3 volumes respectively. In simple terms, industrial and landscape functions had the lowest percentage. Few architecture theses with landscape topic is due to the fact that the reviewed theses were dedicated only to architecture orientation, not involving other orientations such as landscape, itself. Hence taking theses with other orientatins such as landscape into account, it can be

Table 1. Indicator keywords in measuring the texts, relative to the selected functions. Source: authors.

Functions	Indicator keywords
Landscape	garden, park, landscape, urban landscape, nature and nature elements, green spaces, historical landscape, pedestrian way,
Residential	Dwelling, Habitat, Residential Complexes, House, Home, Dormitory
Religious	Religious Spaces or Buildings, Religious Architecture, Mosque, Mausoleum, Tombs, Hosseiniyeh, Mannar, etc.
Industrial	Industrial Buildings or Spaces, Industrial Area & Park, Workshop, Factory, Metrostation, Terminal, etc.
Healthcare	Healthcare Spaces, Healthcare Facilities or Centers, Hydrotherapy, Hospital, Clinic, etc.
Eductional	Educational Buildings, Educational Institute, University, Faculty, Design Studio, Elementary School, Kindergarten, etc.
Administraitive	Administrative Spaces, Administrative Buildings, Administrative Zone or Park, Municipal Building, etc.

concluded that the lowest number of architecture M. A. theses belong to industrial complexes. Studying Ph. D. dissertations of architecture shows that the subject of residential function with 14.35% enjoys the lion's share among other functions. It should be said that among 230 architetcure dissertation in Ph. D. level, only one dissertation dealt with architecture of industrial complexes. All told, it can be concluded that theoretical productions of the country in terms of industrial complex architecture is very insignificant. What is more, by adding the calculated percentages for each of the seven functions, it can be revealed that residential, landscape, and educational functions have the largest part in the produced knowledge of architecture. Briefly speaking, Diagram 1 confirms the small amount of theoretical productions in the architecture of industrial complexes, being an apparent reason on necessity of paying attention to this field.

Evaluation of transitive knowledge dealt with thematic analysis of architecture educational topics in three levels of BA, M. A., and Ph. D.. Accordingly, the description of all courses in the syllabi, adopted by the Council of Higher Eductaion Planning, was carefully studied and evaluated based on the selected functions. Reviewing the comprehensive four-year program of B. A. in architecture confirms that the relation of the adopted courses with the seven functions could be studied in three ways:

A. Unrelated courses: Many B. A. courses of architecture such as "applied geometry", "materials and construction workshop", "mathematics and statistics", "foreign language", "human in Islam", "physical education 1", "building materials", etc. have no relation with the mentioned functions.

B. Shared related courses: Some of the considered courses for this period are shared among the selected functions. "An introduction to islamic architecture", "rural arcitecture", "introduction to building restoration", etc. are examples of shared courses. What is important in these courses is the dissimilarity of their relation to the functions. For instance, in "rural architecture", the significant architecture of rustic units is studied chiefly with rural houses. Moreover, in "introduction to building restoration" significant buildings such as mosques, schools, houses, public baths, etc. receive more research-oriented attention than workshops. A more accurate look confirms the fact that religious, residential, educational, and landscape spaces are vaster with regards to these courses.

A. Specific related courses: Some of the mentioned courses form a specific relation with the mentioned functions. The majority of these courses are architectural designs. Residential spaces (with titles such as villa, home, housing, and residential complex), religious spaces (mostly mosques and prayer houses), educational spaces (like kindergartens, elementary schools, high schools, and colleges), landscape (chiefly parks and green spaces), and healthcare spaces (like hospital) have been the scheme topics in various universities of the country.

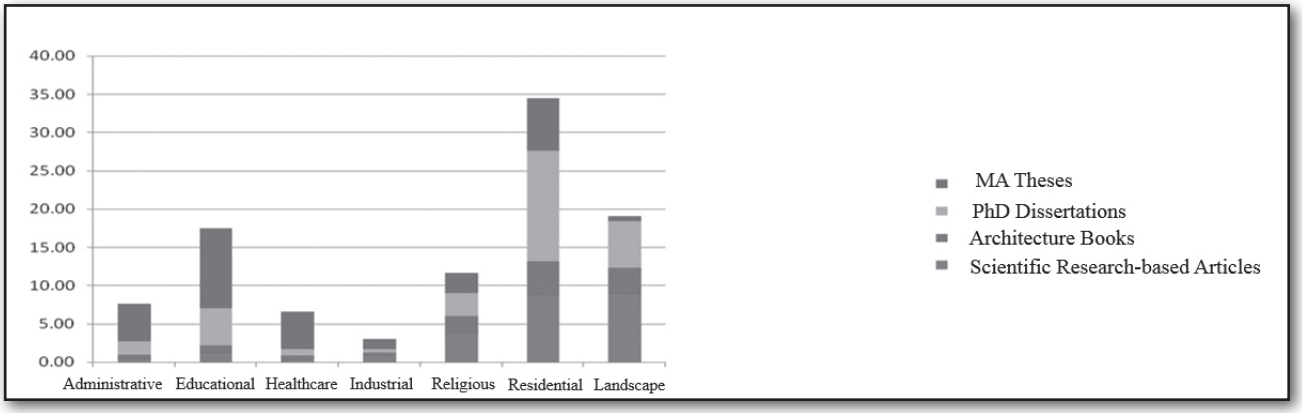


Diagram 1. Total share of different functions in theoretical productions of architecture. Source: authors.

Table 2. Share of different functions in theoretical productions of architecture. Source: authors.

	Journal	Issue	Total	Landscape		Residential		Religious		Industrial		Healthcare		Educational		Administrative		Others	
				N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P
Scientific Research-based Articles	Bagh-e-Nazar	1-31	234	62	26.49	7	2.99	6	2.56	2	0.85	0	0	3	1.28	0	0	154	65.81
	Housing & Rural Environment	123-148	192	5	2.60	53	27.60	0	0	1	0.52	0	0	0	0	0	0	133	69.27
	Soffeh	1-65	449	23	5.12	27	6.01	21	4.68	2	0.44	0	0	5	1.11	1	0.22	370	82.40
	Memari-Va-Shahrsazi (Honar – ha – ye – Ziba)	38-56	162	8	4.94	23	14.20	10	6.17	2	1.23	2	1.23	1	0.62	2	1.23	114	70.37
	Sakhteshahr	1-20	98	1	1.02	7	7.14	0	0	5	5.10	0	0	1	1.02	1	1.02	83	84.69
	Hoviatshahr	1-19	181	20	11.05	17	9.39	2	1.10	0	0	0	0	0	0	1	0.55	141	77.90
	Iranian Architecture Studies	1-6	45	4	8.89	4	8.89	4	8.89	0	0	0	0	2	4.44	0	0	31	68.89
	Urban Studies	1-10	72	9	12.5	5	6.94	0	0	0	0	0	0	0	0	0	0	58	80.55
	Architecture & Urban Planning	1-13	113	6	5.31	14	12.39	5	4.42	1	0.88	0	0	2	1.77	1	0.88	84	74.34
	Studies on Iranian-Islamic City	1-15	132	9	6.81	11	8.33	25	18.94	0	0	0	0	2	1.51	1	0.76	84	65.15
	Naqshejahan	1-6	41	6	14.63	3	7.32	4	9.76	1	2.44	1	2.44	2	4.87	0	0	24	58.53
	Maramat & Memari-e Iran	1-8	61	5	8.20	4	6.56	6	9.84	0	0	0	0	1	1.64	0	0	45	73.77
	modiriyatshahri	1-36	459	26	5.66	20	4.36	3	0.65	6	1.31	1	0.22	2	0.43	1	0.22	400	87.14
	Armanshahr	1-11	123	21	17.07	12	9.76	5	4.06	0	0	1	0.81	1	0.81	0	0	83	67.48
	Iranian Architecture & Urbanism	1-8	74	13	17.57	8	10.81	1	1.35	0	0	1	1.35	7	9.46	1	1.35	43	58.11
			2436	218	8.95	215	8.82	92	3.78	20	0.82	6	0.25	29	1.19	9	0.37	1847	75.82
PhD Dissertations	University	Period	Total	Landscape		Residential		Religious		Industrial		Healthcare		Educational		Administrative		Others	
				N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P
	University of Tehran	1999-2012	51	4	7.84	3	5.88	2	3.92	0	0	0	0	0	0	0	0	42	82.35
	Shahid beheshti University	2002-2012	53	2	3.77	6	11.32	0	0	0	0	0	0	3	5.66	0	0	42	79.24
	Iran University of Science and Technology	2007-2012	47	5	10.64	6	12.76	1	2.13	1	2.13	1	2.13	4	8.51	3	6.38	26	55.32
	Islamic Azad University, Science and Research Branch	2000-2012	74	3	4.05	17	22.97	4	5.4	0	0	1	1.35	4	5.4	1	1.35	44	59.46
	Tarbiat Modares University	2012	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	100
	Tabriz Islamic Art University	2012	2	0	0	1	50	0	0	0	0	0	0	0	0	0	0	1	50
			230	14	6.09	33	14.35	7	3.04	1	0.43	2	0.87	11	4.78	4	1.74	158	68.69
Books	Bookshop	Total Number		Landscape		Residential		Religious		Industrial		Healthcare		Educational		Administrative		Others	
				N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P
	Parham	2500		83	3.32	107	4.28	55	2.2	11	0.44	14	0.56	25	1	14	0.56	2191	87.64
MA Theses	University	Period	Total	Landscape		Residential		Religious		Industrial		Healthcare		Educational		Administrative		Others	
				N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P
	Shahid Beheshti University	2001-2010	470	3	0.64	32	6.80	12	2.55	6	1.28	23	4.89	49	10.42	23	4.89	322	68.51

It is noteworthy that despite the fact that architectural designs are rarely studied with administrative topics, managemental sections are always taken into consideration in different schemes as a subject for designing; therefore, industrial function, compared to other selected functions, is less addressed in B. A. curriculum.

Paying attention to the titles of M. A. fields of study as well as orientations, shows that currently architecture technology with two orientations of bionic and digital (December, 2, 2012 Resolution), architecture engineering (November, 15, 1998 Resolution), Iranian architecture studies (June, 15, 2005 Resolution), architecture and energy (December, 2, 2012 Resolution), interior architecture (July, 7, 2013 Resolution), construction and project management (July, 7, 2013 Resolution), landscape architecture (December, 16, 2012 Resolution),

conservation of historic fabrics and buildings with two orientations of conservation of urban heritage and architecture heritage (December, 9, 2012 and December, 2, 2012 Resolutions), post-accident reconstruction (June, 15, 2005 Resolution), Islamic architecture (May, 8, 2004 Resolution), and educational space design (December, 28, 1997 Resolution) have syllabi, adopted by the Council of Higher Eductaion Planning. Moreover, based on the information, include in course selection guideling for master entrance exam (2014), orientations of housing, healthcare, educational, cultural, and sustainable architecture are being taught in architecture M. A., in addition to the abovementioned courses (Iranian Measurement Organization, 2014: 174-179).

Furthermore, a careful survey of these titles shows that landscape and educational functions have a completely-defined organized field of study. Therefore, in educational programs of architecture these functions are given more attention. What is more, residential and healthcare functions, due to their orientation structure, are placed in the next rank after landscape and educational functions. On the other hand, titles such as Islamic architecture, Iranian architecture studies and the specific area of conservation of (architecture and urban) heritage will be directly connected to religious spaces; therefore, despite no dedication of a specific orientation for religious spaces, these spaces have a lofty place in the mentioned orientations. Briefly speaking, from the seven selected functions in this research, only industrial and administrative ones have no place in architecture courses and orientations in M. A. level. Careful study of the adopted schedules for architecture master degree shows that the most important goal, pursued in its syllabi, is to reach specific orientations. It should be said that the adopted strategy to achieve this goal is the hidden flexibility of the courses and topics. Based on this adopted schedule, the student should pass eight compulsory credits, eight selected credits (from the 24 proposed credits), fourteen designing credits, and two optional ones. Therefore, the faculties, based on the rate and kind of utilizing different expertises, can select appropriate credits and pave the way towards professional activities. On the other hand, in accordance to the contents of this program, topics of architecture designs (including architecture design 1 and 2 along with the final thesis) are not predetermined and depend on the facilities of the faculty, itself (Supreme Council for Planning, 1998: 1-14). In many departmenst of architecture, the mentioned flexibility has degraded to selected courses, and architecture designs are practically administered like previous continuous M. A. s. To put it briefly, the only existing occasion in architecture syllabus to achive industrial complexes' orientation or relevant courses has been diminished.

Resolutions of the Council of Higher Eductaion Planning confirms that currently in Ph. D. of architecture, the courses of architecture (February, 27, 1994 Resolution), conservation (September, 8, 2007 Resolution), architecture technology (December, 9, 2012 Resolution), and landscape architecture (December, 16, 2012 Reslution) have adopted topics and syllabi. The mentioned courses are being taught in University of Tehran, Sahid Beheshti University, Iran Science and Technology University, Tarbiat Modares University, Islamic Azad University Science and Research Branch, Bu-Ali University, Isfahan Art University, and Islamic Azad University. Furthermore, based on the contents in Ph. D. entrance exam guideline, Islamic architecture is being offered at Isfahan Art University of Isfahan and Tabriz Islamic Art University. Additionally, in Imam Khoemini International University, Qazvin, the title of Ph. D. orientation of architecture is buildings and power plant complexes' design (Iranian Measurement Organization, 2011: 60; 2012: 55; 2013: 61; and 2014: 81). A look at the mentioned titles along with their established schemes, it is determined that among the seven functions of the research, landscape is the best-formed function in Ph. D. syllabus. Afterwards the presence of power plant buildings orientation, which is considered as one of the industrial buildings, puts industrial function in the second place of Ph. D. syllabus. Obviously,

religious and educational functions, due to their relation with conservation field of study and Islamic architecture orientation, could be more significant than residential and administrative functions. Summing up the findings of training area confirms that in curricula of B. A. and M. A., the architecture of industrial complexes is given no account and this function, compared to the other selected ones, have a smaller share of educational schedule. This disables the orientation of power plant complexes design in Ph. D. level to appropriately and completely cover the transition of the findings of industrial complexes' architecture. Briefly speaking, the knowledge of industrial complexes' architecture faces an essential challenge in the area of academic transition or training.

Analysis and evaluation of practical knowledge in terms of industrial complexes was divided into two areas of architecture competions and executive projects. What is more, competitions were evaluated in two separate spectra. In the first spectrum, which had a sectional approach, the competitions of a particular period were identified and their themes were put into measurement. These competitions, taking place from 2007 to 2010, included fourty one official competitions (Islami and Soleimani, 2012: 105). Studies show that in this period there was no competition centered on industrial complexes (Table 3). The second spectrum of evaluation deals with periodical competitions of the country, giving somehow similar results. It should be added that architecture prize of Mirmiran, the Competition of Iranian School-Iranian Competition, Abadi prize, and Memar prize are the most important domestic architecture competitions, taking place periodically during recent years. Among them, Mirmiran Prize deals with architecture subjects and concepts chiefly. Iranian School-Iranian Architecture also deals with the subject of schools, having taken place as a conference. Abadi Prize is another authentic competition of the country which took place between 1991 and 1996 by the Ministry of Housing and Urban Development (Diba, et al., 1998: 24). It is noteworthy that during this period there were nineteen competitions, among which there is no sign of industrial complexes as the theme. Among the mentioned prizes, the memar Prize lasted more. Studies show that from a sum of fourteen Memar Prizes (between 2001 and 2014) only five projects were shortlisted that dealt with industrial function. The mentioned projects managed to gain the prize in 2001 (one project), 2003 (one project), 2005 (one project), and 2007 (two projects). Presence of five industrial projects among 99 selected ones in this competition indicates that the share of the chosen industrial complexes among other functions is not much significant. In sum, it can be concluded that the architecture competitions, taking place inside the country, did not cause much concern to promote architectural design for industrial complexes.

In order to evaluate the executive projects, the industrial units, built in Caspian Industrial Park, Qazvin, were selected as the statistical population, among which 63 industrial units were analyzed. As Table 4 shows, the form of the main building in these units was classified and evaluated. Findings confirm that the majority of used forms in these units were cliché and novelty, as one of the considered criteria of architecture, was not the designers or constructors' concern. Also the findings show that a construction material like brick is the most important functional materials in the main building of these units (Table 5). The analyses indicate that the architecture of present industrial units has technical, qualitative, and architectural weaknesses. Considering the number of industrial units, constructed throughout the country, one can claim that the problems in the area of practical architecture of such complexes are mostly qualitative than quantitative. Nonetheless, the evaluation of competitons, which by itself is a part of experimental activities, shows that quantitative problems of architecture in industrial complexes go back to the quantity of architectural attempts (i.e. novel designs).

Table 3. Thematic division of architecture competitions, which took place between 2007 and 2010. Source: authors.

		Quantity	Competition Title
Commercial		9	Indusries Trade Center of Iran (2007); Andisheh Trade Center (2007); Bagh-e Noor (2007); Pasargad Village (2007); Elevation of Carpet Internationl Trade Center of Tabriz (2009); Alborz Trade Center (2010); Amiran Furniture Market in Tehran (2010); Building Industry Trade Center (2010); Tisa Complex in Kish (2010);
Cultural &Religious		5	The Great Aderyan (2007); Mosque of Hashtgerd New City (2008); Karbala Holy Shrines (2008); Cultural Heritage Museum of East Azerbaijan (2009); Engineers Club of Gilan Engineering Organization (2010);
Educational		3	Elementary School Design (2007); Site Planning of Islamic Azad University (2008); Prototype for Faculties of Science & Research Branch (2010);
Residential		2	A House for the Year 2050(2008); Residential Prototype (2009);
Welfare Servises		1	First Rate Welfare services complex (2010);
Administrative		1	Engineering Organization Building of Khozestan Province (2009);
Others	Monumental/ Memorial/ Entrance/…	18	Entrance of Tarbiat Modares University (2007); Entrance of Tabriz University (2007); Entrance of Shiraz University (2007); Entrance of Hoze Honari (2007); Martyrs Memorial of Imam Khomeini International University (2007); Memorial of Chemical Bombardment Disaster (2007);Islamic Azad University Square (2007); Memorial of Passenger Airplane 655 Martyrs (2008); Memorial of The Holy Defense Museum (2008); Entrance of Soore University (2008); Monumental for Shams-e Tabrizi (2008); Entrance of Haj Organization (2009); Memorial of Aashoraian (2009); Urban Monumental of Abaadeh Vali-e-Asr Square (2009); Entrance of Behesht-e Zahra (2010); Sign of Mashhad Palaestina Square (2010); Memorial of Karoon 4 Powerplant & Dam (2010); Concept of Imam Airport Control Tower (2010);
	General	1	Iran 2025(2010);
	Interior	1	Hall of Tehran International Tower (2009);

Table 4. Classification of used forms in the architecture of industrial buildings in Caspian Industrial Park, Qazvin. Source: authors.

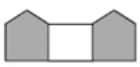
Class & Type	Class 1					Class 2
	T:1	T:3	T:13	T:15	T:18	T:20
Form						
Number	20	8	6	1	1	1
Class & Type	Class 3				Class 4	Class 5
	T:2	T:4	T:7	T:9	T:12 T:5	T:19
Form					 	
Number	5	4	4	1	1	2 1
Class & Type	Class 6				Class 7	Class 8
	T:8	T:6	T:14	T:17	T:11 T:10	T:16
Form					 	
Number	2	1	1	1	1	1 1

Table 5. Classification of the used materials in the walls of industrial buildings in Caspian Industrial Park, Qazvin. Source: authors.

	Type 1	Type 2	Type 3	Type 4
Material	Brick	Brick & Sandwich Panel	Sandwich Panel	Brick & Sandwich Panel& Prefabricated Concrete Panel
Number	37	24	1	1

Conclusion

Thinking over the research findings in the evaluation of produced knowledge confirms that thematic rate of the seven functions was not equal in the written areas and industrial complexes had the smallest production. In other words, development of theoretical knowledge in terms of industrial complexes' architecture faces the challenge of quantity. On the other hand, findings from the evaluation of transitive section indicate a similar challenge, namely ignorance of schedules, orientations, fields of study, and even courses from industrial complexes' architecture, which has caused the architectural theme of this fuction in educational system to be diminished compared to other slected functions. Therefore, research results show that the development of architecture knowledge in terms of industrial complexes faces quantitative challenges in theoretical and transitive areas. Furthermore, considering the applicative area, it is revealed that in practical world industrial complexes face quantitative challenges (chiefly in terms of architectural competitions along with novel and patterned designs) and qualitative ones (majorly in terms of the existing complexes). In the absence of mental roots productions in theoretical and lack of training the experts in the transitive area, the development of these complexes in the practical area (whether consciously or unconsciously) has been aware of quantitative growth, ignoring architectural qualities in many cases. Moreover, since the theme of industrial architecture was not realized in the country's competitions, other qualitative stimuli (such as better architecture designs) were not given a chance to show up. In such circumstances, one may claim that the essential challenge of the practical area is more qualitative than quantitative. The causes of the abovementioned challneges should be investigated. The fact that the industrial function has the smallest share in written areas might be due to lack of attention of archietcural training programs to this function. A scrutinizing look at the studied books in this research shows that there is a close relation between fields of study and orientations in architecture with the titles of written books. The formation of such fields of study and orientations as technology, project management, energy, sustainability, etc. in recent years has become a strong motivation for writing textbooks. The result of this current is a vast spectrum of books that are in line with different discussions of these fields of study (Table 6). In addition to common concerns of written books and the adopted fields of study, another factor that can approve their solidarity is to be more precise in the history of both. A one-to-one correspondence between the books and the courses is another decisive reason to show the impact of educational programs on writing newer and more books (Table 7). In these circumstances one may claim that the absence of industrial complexes in educational and training programs has decreased the necessity of writing books in this area. In simple terms, the shortage of specific books in terms of industrial function is intertwined with educational and training programs. With a similar deductin, one can relate the decrease in the number of articles and M. A. theses to the courses as well. Thus, promoting the quantitiave status of articles, books, and professional theses in terms of industrial complexes depends on the correction of educational program, which can be achieved by offering some strategies such as establishment of an educational program to create the orientation of industrial complexes' design in M. A. in architecture, giving account to relevant courses in M. A. and driving the discussions towards industrial function, dedicating one of the architecture projects in BA to industrial complexes, encouraging the students to choose lesson projects, centralized on industrial complexes, etc. On the other hand, correction of educational programs is considered an exit from transitive challenges. In these circumstances, one can be hopeful that the necessary conditions to promote the practical or functional knowledge have been provided. So far, it has been clarified that promotion of theoretical and transitive knowledge depends on educational programs. All the same, teaching needs scientific discussions or theoretical productions. Thus, to advance the mentioned areas, they are inter-dependent and the development of one is in the development of the other, a fact, the incoherence of which has led to a sectional and discrete growth of different parts of this knowledge.

Table 6. Theamtic relation of books with orientations and achitetcure fileds of study. Source: authors.

Course	Book
Technology	New Materials & Advanced Methods (Vafamehr, 2012); Architecture & Industrial Construction of Building (Vafamehr, 2013); Structure as Architecture (Translated by Golabchi & Sorooshnia, 2009); Understanding Structures (Gohabchi, 2003); Principles of High-rise Buildings Design (Golabchi & Golabchi, 2013); Iranian Architecture Technology (Golabchi & Javani Dizaji, 2013); etc.
Sustainability	Housing Development in Agreement with Sustainable Development (Mahmoudi, 2009); Sustainable Housing: Principles & Practice (Translated by Zarghami, 2015); Sustainable Architectural Values of Iranian Traditional Schools (Ghaffari, 2001); Urban Sustainable Development (Navabakhsh & Arjmand Siahpoosh, 2009); The Sustainable Urban Development Reader (Zaker Haghighi Afvashteh, 2005); Strategies for Sustainable Architecture (Translated by Nasiri Majd & Nejati, 2015); etc.
Technology-Bionic	Bionic Architecture (Ahmadi Shalmani, 2009); Bionic Architecture (Golabchi & Khorsand Nikoo, 2014); Biomimetics in Architecture: Architecture of Life and Buildings (Translated by Flahat, 2014); etc.
Technology-Digital	Digital Architecture (Golabchi et al., 2001); Digital Design Processes (Khabazi, 2014); etc.
Inerior	Interior Illustrations (Moslehi, 2008); Interior Color by Design: A Design Tool for Architects, Interior Designers, and Homeowners (Translated by Paidardarian, 2008); Interior Design Illustrated (Translated by Mahmoodi & Godarzi, 1999); Design in Interior Architecture (Tayefeh, 2013); etc.
Energy & Architecture	Renewable Energies (Saghafi, 2009); 101 Roles of Thumb for Low Energy Architecture (Translated by Sabet & Mohammadpour, 2015); Architectural Design Principal Compatible with Climatic Conditions of Iran with Focus on Mosque Design (Tahbaz & Jalilian, 2008); Solar Power Your Home for Dummies (Translated by Mahdlou, 2012); etc.
Islamic Architecture& Iranian Architecture Studies	Mausolean Monuments (Oghabi, 1999); Introduction to Persian Islamic Art (Shayestehfar, 2013); Art & Architecture Bibliography after the Revolution (1997); The Islamic Art and Architecture of Iran in Memory of Latif Abolghasemi (Omranipour, 2005); Encyclopedia of Iranian Art and Architecture Based on the Grove Art Culture (Tabatabai, 2012); etc.
Project Management	Principles of Project Management (Golabchi & Hosseini, 2010); Project Management & Ethics (Golabchi & Amiri, 2014); Project Control & Management (Haaj shir Mohammadi, 1999); Project Management for Facility Construction (Translated by Taghizadeh et al, 2013); A guide to the Project Management Body of Knowledge (Translated by Aladpoush, 1998); Project Management Institue Practice Standard for Work Breakdown Structures (Translated by Rezaei Vesal, 2013); etc.
Restoration	Technology of Architectural Restoration (Falamaki, 2008); The Experiments about Restoration of Urban Facades (Sadat Mojabi et al., 2015); Twelve Lessons on Restoration (Asghar Moradi et al., 1995); etc.

The first sectional growth in the body of architecture knowledge in terms of industrial compexes, deals with the quantitive growth of practical knowledge in the absence of produced and transitive ones. In such circumstances, the sectors of theoretical production and transition have not been able to be influenced or affect the executive architecture. Also in the absence of this scientific interaction, the architecture of industrial complexes in the practical section has turned to quantitative growth. The second sectional growth has happened in the transitive section and with the formation of architecture Ph. D. with the orientation of buildings and power plants' design in Imam Khomeini International University. Having occurred in order to develop architecture sicence, this has had a detaied perspective, resulting in a deep gap in the body of architecture knowledge. The gap is very apparent when studying B. A. and M. A. syllabi, where there is not even a single course on industrial complex architecture. The third sectional growth has taken place in the knowledge of industrial complex design, outside the borderlines of architecture. During recent decades, other fields of study or sciences such as industrial engineering, manufacturing, computer, economy, rural development, etc. have made several theoretical and practical attempts to design these complexes. Absece of architecture knowledge or its disassociation with other relevant professions have caused the majority of these professionals' attempts to be confined to the subject of locating and layouting industrial units with the priority of material flow optimization. In this way, the designs of industrial complexes in their best level have resulted in separate design of layouts and shelters. To put it briefly, in terms of industrial complex design, Iranian architecture knowledge faces the challenge of sectional

Table 7. Thematic relation of books with courses. Source: authors.

Syllabus	Book
▪ Geometry of Views and Perspective	▪ Geometric of Perspective (Bina, 2008)
▪ Building Materials	▪ Building Materials (Ebrahimi et al, 2006)
▪ Statics	▪ Structures for Architects (Madandoust & Khodaparast Haghi, 2006)
▪ Human, Nature, Architecture	▪ Human, Nature, Architecture (Golparvarfard, 2012)
▪ Environmental Condition Adjusment	▪ Environmental Control (Ghiabaklou, 2015)
▪ Buildings 1 & 2	▪ The Constuction of Building (Zomarshidi, 2008)
▪ Introduction to World Architecture	▪ Getting to Know world Architrcture (Zarei, 2008)
▪ Electrical Installations	▪ Power Facilities in Architecture (Safavipour, 2010)
▪ An Introduction to Islamic Architecture	▪ Iranian Architecture; Islamic Period (Kiani, 2000)
▪ An Introduction to Contemporary Architecture	▪ Theories and Concepts in Contemporary Western Architecture (Ghobadian, 2003)
▪ Rural Architecture 1 & 2	▪ An Introduction to the Iranian Rural Architecture (Zargar, 1999)
▪ Theoretical Basis of Architecture	▪ Lesson on Architectural Theory (Islami, 2013)
▪ An Introduction to Building Restoration	▪ Aquaintance with Restoration of Monuments (Tabibiyan, 2011)
▪ Theory & Architecture Methods	▪ Design Analytica (Rezaei, 2014)
▪ Environmental Psychology	▪ Environed in Environment (Shahcheraghi, 2015)
▪ …..	▪ …..

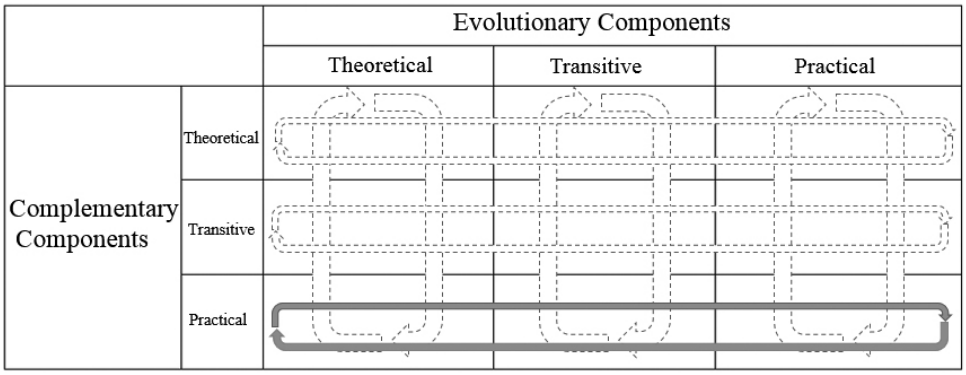
and discrete growth in addition to its numerous quantitative challenges.

As aforementioned, to realize the challenges, posed in the development road of architecture knowledge for these complexes, helps programming and adopting appropriate guidelines to meet them. Another look at the basics of architecture knowledge development indicates that complementary components have a matrix-like connection with the evolutionary ones. In such matrix-like integration, theoretical productions could be a consequence of evaluating all three theoretical, transitive, and practical areas. Similarly, transferring the educational topics could originate from the context of theoretical productions, criticism, training, scientific experience of previous lessons, or project evaluation. Of what was mentioned, it seems that cohesion and matrix-like connection should be included in development planning of this knowledge as two essential characteritics. Now, to find the beginning point (or priorities) of thorough development of architecture knowledge in industrial complexes shows its significance. In the three evaluations, it was seen that architecture knowledge in all three areas of production, transition, and application face essential challenges. Nonetheless, the architecture of industrial complexes in the absence of theoretical and transitive areas follows its practical path, forming a vast expansion of industrial units in this road. Hence as it can be seen in the matrix model of knowledge development of industrial complexes, the cycle of practical knowledge (in line with the evolutionary component) has become a unique and sectional current. Obviously, in such circumstances, the cycle of evolutionary components, crossing the practical cycle have greater ability to begin the movement. In simpler terms, the cycle of practical movement could be considered a turning point for matrix programming, becoming a symbol of production in other cycles (Table 8). What was mentioned above confirms that moving in line with complementary components in order to trigger movement in evolutionary ones is the most appropriate strategy for developing the architecture knowledge in these complexes. This strategy, which begins from the practical area and tries to extend the eperiences of this area to transtive and theoretical ones, behaves like a reverse approach in engineering action, trying to use the grown areas like a catalyst for the growth of other sections. Accordingly, other developed areas such as educational programs of power plant buildings design as well as theoretical productions of other fields of study could be used to develop the less-grown areas.

All told, it is reminded that from a two-by-two comparison of complementary and evolutionary componenst of knowledge development could be used to extract varied research- and non-research-based programs. Neveretheless, economic factors and the rate of their influence in quantitative-qualitative development of

industrial spaces, psychological topics of audience's encounter with industrial complexes, identification of effective parameters on architecture design of industrial complexes, necessities and obstacles for the formation of industrial complex architecture orientation, solidarity of efficiency in industrial complexes with architecture qualities, chronology of industrial complexes in Iran and the world, integrity of interdisciplinary discussions such as appearance with efficiency of the workers in industrial complexes, and industrial methods of construction and their influence on the efficiency of industrial projects are just a small group of researches that can be recommended in the recent conceptual model for the development of architecture knowledge in industrial complexes.

Table 8. The existing complementary-evolutionary components of the development of architecture knowledge on industrial complexes. Source: authors.



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