

# **Future Skill-Shortages in the Engineering and Architecture Professions: Lessons from the Lebanese Case**

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## ABSTRACT

The construction sector is undergoing rapid global changes that calls for a reform in the architecture and engineering education. In our survey, we identified 3 factors - thus called "influence factors" - that are radically transforming the professions of architects and engineers: technological innovation, global outsourcing of construction services, and the organizational shift toward a more fluid work environment. This paper analyze how these 3 influence factors will affect the employability and the future skill-gap, suggesting substantive recommendations for the engineering and architecture education, with a view on their implementation.

Architects and engineers are expected to deploy appropriate skills and attitudes if they are to adapt to a multicultural working environment. Lebanon is an interesting field to study skill-shortage, future occupations and career opportunities within these professions due to its booming construction sector and its high level of integration with neighboring Arab Gulf countries. Our major findings indicate that big companies are achieving a better integration between the internal and the external components of the organization by outsourcing low-value tasks and reinforcing multidivisional coordination. Thus, a successful firm is the one that has established a balance between investing in core competencies and outsourcing peripheral tasks or jobs. Organizational fluidity, skill adequacy and the promotion of cultural values are becoming crucial for excellency in the construction sector. Consequently, architects and civil engineers are expected to be more and more creative, delivering unique models and original designs, while they are asked in the same time to execute more managerial tasks and resource sharing within interdivisional committees and multidisciplinary teams.

## Introduction

In the construction sector, the accelerated technological innovation is permanently requiring new skills for emerging tasks. Firms have to adapt to an increasing global competition, with an unprecedented level of outsourcing, and constantly changing legislations and rules (such as new safety norms, construction regulations or environmental concerns). The ongoing process of global outsourcing of construction services is not merely an exogenous constraint to which firms could passively adapt. It is rather a radical shift in the working environment, calling for a radical reform in architecture and engineering education.

With scientific advancement in materials science, nanotechnology, or biotechnology, it became trivial to say that architecture and engineering education need to be tailored to match future jobs. Our article is not intended to repeat such truism. It rather aims to identify the most crucial future skills for architects and engineers competing within multicultural fluid organizations. Our survey suggests substantive recommendations for Higher Education Institution, with a view on their implementation.

In the Arab countries, such studies are scarce despite the boom in the construction sector, with little shared knowledge on skill-shortage, future occupations, current and future skills requirements for engineers and architects. Lebanon is an interesting field study, due to its high level of integration with neighboring regions, especially the Gulf countries. Indeed, the construction sector is a major asset for the Lebanese economy, with more than 1000 firms concentrated in Beirut, the capital, and its neighboring areas [Table 1]. Although Lebanon is one of the smallest countries in the Middle East, the morphology of its construction sector shows a large number of big firms exceeding 200 employees, highly involved in the construction boom in neighboring regions. Moreover, the Lebanese *Higher Education Institutions (HEI)* play a pioneering role in the skill supply on the regional level.

Firm Category	Excellent	first	2nd	3rd	4th
number of firms	107	173	178	394	308

**Table 1- Number of firms by category - CCIA-BML, 2014**

In this article, we follow a prospective methodology called PROMENIA, a qualitative research method that we adjusted to the Lebanese employment and labor market in order to predict future skill-needs and skill-shortages in the engineering and architecture professions<sup>1</sup>.

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<sup>1</sup> This methodology was first established and implemented by researchers from the University of Strasbourg and slightly adjusted to the Lebanese labor market, as part of the European project, PACOME, funded by the European Commission. The project was dedicated to study skill-shortage, future occupations and future career opportunities in Lebanon, between 2012 and 2016.

The starting point of our methodology is a prospective analysis of employer's needs through interviews and focus groups with key-informants and stakeholders from the leading firms in the country. Information was gathered on current and expected employment, skill-shortages, and future skill-needs. Our informant were asked to discuss different scenarios in which various factors are radically transforming their jobs. Therefore, we identified 3 "factors of influence" affecting architecture and engineering professions: technological innovation, global outsourcing of construction services, and the organizational shift toward a more fluid work environment, with more flexibility and less boundaries.

Our labor market data were collected in 2014 through the registers of the Chambre of Commerce, Industry and Agriculture of Beirut and Mount-Lebanon (CCIA-BML). We identified a pool of 1160 firms, divided into five categories (excellent, 1, 2, 3, 4). In our focus group, we selected experts from the first 2 types of firms ("Excellent", meaning more than 100 employees, and "category 1" meaning 50-100 employees) for whom public information was available, in order to establish a questionnaire. This qualitative method was followed by a complementary quantitative analysis, through a semi-structured e-questionnaire submitted to 150 selected companies, half of them was small firms, and the other medium-sized business and leading companies. The response rate was around 30%, with 43 questionnaires actually filled-out by HR managers.

In our questionnaire, respondents were asked to assess the core competencies needed in key-positions and high-values activities, identifying future skills needed to improve efficiency in their work environment. They were also asked to evaluate several recruitment policies for different jobs or training programs. Finally, they described the effects of the 3 "influence factors" on their professions, discussing different scenarios of skill-shortage.

While our qualitative analysis suggest several noteworthy points, more research is needed due to the lack of quantitative studies in Lebanon, (lot of data are simply inexistent such as recruitment needs, frictional unemployment, structural unemployment, average wages, etc.). Nevertheless, our research indicates that the construction sector will continue to play a strategic role in the development of the Lebanese economy, and the demand for more creative architects and engineers will continue to rise. Thus, the quality of education and training is expected to contribute to the growth of the national economy, as well as the general wellbeing of individuals.

Our prospective analysis run in three major steps. First, we scan the morphology of the construction sector in Lebanon by identifying key firms and key positions within these firms, in order to understand how the influence factors are affecting the market structure: these morphological repercussions will be called the structural effect [*section 1*]. Second, we unravel the occupational effect by analyzing how the influence factors are specifically modifying jobs, tasks and activities, in order to build different scenarios for the evolution of future skill-needs [*section 2*]. Finally, we

try to assess the impact of identified changes on skill-requirements and skill-shortages, suggesting major recommendations to reform curricula and competencies framework in order to reduce the skill-gap [section 3].

## I- THE CONSTRUCTION SECTOR IN LEBANON AND ITS GLOBALIZATION

In this section, we describe the morphology of the construction sector in Lebanon by identifying key firms and key positions within these firms, in order to analyze the structural effect, intended to understand how the influence factors are affecting the market structure.

### a) The morphology of the construction sector in Lebanon

First of all, the real estate and the construction industry occupy a major position in the Lebanese economy. We estimate that they both account for the fifth of the Lebanese GDP, on average, since 2004. Indeed, the Construction sector account between 4% and 6% of the GDP, between 2004 and 2013, year of the last available data in the Lebanese National Accounts<sup>2</sup>.

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Added Value	1,209	1,240	1,303	1,666	2,034	2,677	2,233	2,690	3,434	4,437
% GDP	3,8%	3,8%	3,9%	4,4%	4,6%	5,0%	3,8%	4,5%	5,2%	6,2%

**Table 2- Added Value in the Construction sector (Billion LBP - Current prices)**

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Added Value	4,829	5,023	5,127	5,252	5,715	6,271	7,434	8,317	9,276	9,980
% GDP	15%	16%	15%	14%	13%	12%	13%	14%	14%	14%

**Table 3- Added Value in the Real Estate sector (Billion LBP - current prices)**

The real estate sector account between 14% and 15% of the GDP. The accelerated growth after 2007 reflects the need for reconstruction after the 2006 war, and the rise in the price of real estate and construction material.

<sup>2</sup> In the National accounts, the real growth of the sector is inferred from statistics on raw material, (local cement, and imported products used in building and public works). The variation of construction prices is estimated as a function of the weighted average of changes in the wages of manual workers and the prices of raw materials.

Using the fixed price of 2010 as a reference, we find that these two sectors are experiencing a rapid acceleration in the real growth rates [Table 4], and we may conclude that they both accounts for around 17% of the real GDP.

Year	2010	2011	2012	2013
<b>Added Value Construction</b>	2,233	2,305	2,318	2,489
Growth rate construction %	3%	1%	7%	7%
% GDP (fixed prices 2010)	4%	4%	4%	4%
<b>Added Value Real estate</b>	7,434	7,396	7,398	7,867
Growth rate Real Estate %	-1%	0%	6%	6%
% GDP (fixed prices 2010)	13%	13%	12%	13%

**Table 4- Added Value in Real Estate sector (Billion LBP - Fixed prices 2010)**

Taking into consideration the general population growth and the demographic repercussions of the Syrian refugees in Lebanon, as well as the related need to modernize the Lebanese infrastructure, more projects will be needed to design and construct or expand transportation, water supply, waste management and pollution control systems, as well as to maintain existing highways, bridges, and other public structures. Thus, the demand for skilled engineers and architects will continue to rise in the coming years, especially with the eventual special opportunities that may be offered to Lebanese firms in the post-war reconstruction of Syria.

#### **b) The structural effect: recent evolutions in the market structure**

Typically, companies are organized by products, customers, and territories. They all share the same functional vertical organization, where everything is related to the company's name, or the chairman's name (even in the leading companies). The sector is characterized by a clearly definable and valuable body of knowledge and experience, as well as its strong Order (union) that unifies the norms for all professionals and ensures rigorous entry standards backed up with specific requirements to register with the Order.

The Construction sector in Lebanon covers a wide range of activities in many different industries, such as infrastructure, building construction and development projects, demolition, wrecking, drilling or design. Architecture and engineering professions include a variety of skills that cover a wide range of activities including non-residential buildings, residential construction projects, civil engineering projects such as roads and bridges, mechanical engineering, interior design and decoration. Many achievements can be noticed throughout the country, not only in the

reconstruction of the downtown of Beirut, but also in other sectors like lighting, waterfront marinas, and renovation of historical buildings and the built Heritage.

CODE	ACTIVITIES
45110	Demolition & wrecking of buildings, earth moving
45120	Test drilling and boring for construction
45210	Construction of buildings & civil engineering works
45230	Construction of highways, roads, airfields & sport facilities
45240	Construction of water projects
45260	Construction of water systems
45270	Electrical contracting
45311	Installation of electrical wirings and fitting
45320	Installation of thermal and sound insulation in buildings
45451	Construction of swimming pools
74210	Civil engineering, architecture & Construction studies
74220	Mechanical engineering studies
74230	Topographic & geotechnical studies
74843	Interior design and decoration

**Table 5 - Construction sector - Registered firms (by activity) - CCIAB-ML, 2014**

The Lebanese sector is not very dependent on public funds, with a continuous increase in private investment in real estate, especially from 2007 till 2012, and an important flow of global capital (especially in tourist industry). Although the majority of the 1160 firms of our study are concentrated in a very small geographical area (Beirut and its neighboring regions), the industry is highly segmented.

The ongoing fragmentation of the industry is correlated with the rapid growth of small subcontractors, the increasing process of outsourcing of construction services, as well as the rise of self-employment and individual enterprises, especially in design and animation services. Accordingly, architecture and engineering professions have evolved into a multidisciplinary structure organized around a number of corporate networks and technologically advanced globalized firms.

The Lebanese labor market is undergoing gradual structural changes in the supply and demand of skills. The supply of skills is unstable, due to the rapid increase in the number of private universities, to dramatic political and social changes in the Arab world affecting the migration of the labor force. The instability in the skill supply is aggravated by global factors driven by the rise of a "new economy" based on information, knowledge, innovation and creativity. These factors are generating skill-shortages in the construction sector, a skill mismatch between the increasing

needs for more creative labor on the employment market and the outdated curricula of Institutions of Higher Education.

Our analysis of the market structure shows that architecture, engineering, and design are converging into one multidisciplinary field and network. The value chain is divided into primary and support activities. Primary activities contribute to the physical creation of the product, sales or distribution, as well as after sale services. Support activities assist the primary activities but are increasingly subject to outsourcing in the architecture and engineering professions. Firms outsource support activities not only because it is cheaper; it avoids them to be restricted to one technology, or specific skill that may become obsolete. Consequently, the Lebanese market is structured around a central hub of huge companies surrounded by networks of alliances and partnerships with small suppliers and subcontractors.

The industrial effect may be described as follow:

- Various types of firms use different technologies, so very specialized skills may be required in each one. Indeed, a lot of generic skills may be common to all the companies in the sector, but the core competencies that are strategic to each one may be specific, knowledge-based and non-transferable to other occupational types.
- The construction sector is organized around a huge number of small firms subcontractors whose proportion continues to grow, in a market dominated by few big companies, with only 107 firms out of 1160 counting more than 100 employees.
- The segmentation of the sector and the extension of very small enterprises (700 firms with less than 10 employees) is an indicator of a high level of subcontracting.

This industrial effect is inducing a shift in the recruitment policies. Leading firms competing on a larger scale need to hire the most creative and autonomous architects and engineers and to provide them with continuous training for sales, management and leadership. These corporations need to work closely with suppliers and loyal clients, through various types of alliances and partnerships, and thus, they need to identify the core competencies and the strategic skills to keep-in-house and to build-on. Finally, the industrial effect shows also that roles and functions of architects and engineers are not as simple to define as it was in the last decades, since they are more and more assuming the fluid and not-well-defined tasks of managers, team leaders and negotiators. Consequently, Institution of Higher Education should adapt to the requirements of the new organizational structure.

Indeed, globalization of engineering and architecture services is facilitated by the lower costs of high-skilled labor coming from developing countries as well as by progress in education and information technologies in these countries. Thus, outsourcing of engineering and architecture services will continue to increase, driven by the lower costs. Lebanon is already benefiting from this trend since a lot of firms based in the Gulf are currently outsourcing some services towards the Lebanese market (especially, consultant services, conceptualization and design). The back-side of this trend for Lebanese firms is the increased instability of skill supply and demand on the local employment market, with a concrete risk of brain drain associated with a decrease in engineers and architect jobs. The process of



outsourcing is also unstable, and the demand for Lebanese firms in the Gulf may not last, especially for services related to routine work, since engineers and architects from India are more and more preferred. Innovation and creativity combined with the highest levels of expertise will be the added value that prevents non-routine work from being lost, at least as long as Lebanese professionals maintain their competitive advantage.

The increasing demand for engineers and architects will also be affected by globalization and by the use of new and more sophisticated industrial technologies. These factors may have paradoxical impacts on the Lebanese labor market, resulting in a widening gap between skill supply and demand. On one hand, the skill supply for qualified engineers and architects is mainly a domestic issue, related to higher education policies and reforms; on the other, the future needs of the market are driven by global trends that are difficult to anticipate by Lebanese universities and local policies. Thus, there might be a significant gap between what universities are expected to do and what they are currently doing in order to survive in a rapidly changing environment.

Keeping in mind that an increasing number of freshly graduates are immigrating to Arab countries, especially in the Gulf, the HEI are facing a difficult challenge, with contradictory exigencies: on the local scale, they are competing with each others to attract the largest number of students through traditional standard programs focused on generic and transferable skills; on the regional scale, they have to compete with international programs in order to provide highly-skilled labor capable of embracing a wide range of new technologies and material.

The migration of skilled professionals from the country is an increasing source of concern, and the first benefactors are Arab Gulf countries. The Gulf trend is a local form of globalization that seems particularly important in civil engineering and architecture because of the increasing demand for the Lebanese graduates and professionals in many design and construction companies in the Arab world. In the same sense, Lebanese firms should learn to compete globally (or regionally) in order to survive.

In conclusion, the global, regional and local need for better infrastructure will continue to drive demand for professional architects and engineers in the coming years. The demand for professional civil engineering services will continue to grow and more skilled professionals are needed to conceptualize, to design, and to implement new projects within a rapidly changing social and political environment.

## **II- THE OCCUPATIONAL EFFECT: NEW SKILLS AND TASKS**

In the past section, we identified three factors that are modifying the structure of the construction sector: globalization, new technologies and the increase need for flexibility and creativity in the new corporate model. This section is dedicated to study the occupational effect, which is intended to understand how the three

identified “factors of influence” are modifying the skill-demand in the architecture and engineering professions. In our survey, technology was considered by 65% of the respondents as the major factor influencing the profession, and it was associated with higher productivity and better quality of services. On another hand, 47% of the respondents considered that intercultural and environmental concerns are radically transforming their business by increasing the future need for creative architects and engineers in leadership position, especially for female professionals. Similarly, 37% of the respondents considered that these cultural changes in the working environment will lead to the emergence of unprecedented fields of expertise. This section will analyze how architecture and engineering professions are affected by these major changes, and which skills will be crucial for future occupations.

### **a) Technology and the emergence of new occupations and tasks**

In the last decades, technology has changed almost everything about the engineering and architecture professions. Technology has significantly transformed the work environment, the material, the conceptualization and the execution, opening new horizons for creative skills within the sector.

First of all, since some engineering and design services may be carried out remotely, technology is increasing the opportunities of outsourcing with lower costs. Secondly, new software programs are reducing the transaction costs of projects, and the time required to accomplish engineering analysis. Internet and e-mails are increasing the possibilities of interactions around the globe, and with other counterparts inside the firm environment. As a result, firms have access to a more diversified architecture and engineering staff from different educational background. In parallel, clients have become more connected with the suppliers, and project partnerships, both among and with clients, are more common. Finally, technology is transforming the regulatory framework, introducing new standards and norms, with more concern for the environmental impact of the project.

With new technologies, new specializations have emerged, creating new opportunities and more jobs, especially in program management and specialty subcontractors. The growing dependence on technology has increased the demand for communication and management skills, as well as for leadership skills among architects and engineers as we can see in the list of tasks that are common to both professions:

- To protect the public’s health, safety and security;
- To understand and to respect regulations, local practices and international standards;
- To control and to execute parts of a project, including design criteria, analysis methods, and material selection, in collaboration with co-workers and teams;
- To communicate and to discuss with colleagues and teams, with various stakeholders, especially legal advisors and public sector officials;
- To participate in collaborative work with different teams, and to communicate architecture and/or engineering requirements and expectations, in order to achieve the project goals or solve technical problems;

- To create and evaluate alternatives in order to provide cost-effective, sustainable solutions, adjusting each project to the clients' needs
- To minimize the environmental impacts of projects, while satisfying the cultural, legal, and environmental standards.
- To supervise or to prepare plans, specifications, and reports;
- To address questions related to decisions and requirements, acting as a creative authority during the planning and the design phases, while acting as a technical authority during the construction phases;
- To initiate and maintain collaborations with key engineers, architects from different departments or other partner/alliance companies, as well as officials in order to facilitate negotiation and consultation.

As we can notice from the list above, the tasks required from engineers and architects in the new corporate model include some soft and generic attributes that go beyond technical achievement and excellence. The demand for these generic attributes will keep growing since the globalization of services and the technological changes will continue to shape work environment, restructuring it into a more fluid and collaborative network.

Most importantly, freshly graduates are currently lacking on their first day of work the appropriate skills that may allow them to accomplish these new tasks, especially: team building skills, strategic thinking, effective communication skills, ethics and respect for collaborators from a different cultural background. Our research indicates that these basic skill-shortages call for or a change in the education system that should be enhanced to include team building skills, intercultural communication and language competencies.

#### **b) New tasks for architects and engineers in leading positions**

As more collaborative tasks are required from any engineer or architect, firms are less likely to invest in training for routine activities, or tasks requiring generic skills that might be transferable from one firm to another. On another hand, the profile of engineers and architects in leadership positions requires more specific skills, which need to be adjusted to each particular context, and leading companies are in need of a greater focus on leadership skills, especially:

- To apply analytical skills from math and science to concrete specific and unique situations;
- To reach optimal solutions with the lowest cost and the most feasible and efficient way;
- To apply organizational development skills and managerial skills that are located in a "more abstract" set of interpersonal skills in order to enhance cooperation and coordination within each project team and between different teams;
- To identify and develop specific qualities or attitudes required for long-term leadership and to encourage autonomy and creativity among his/her co-workers.

In conclusion, leadership skills, communication skills, and managerial skills cannot be considered anymore as merely administrative supplement to the profile of a successful engineer or architect. They are becoming the core values of the profession as well as strategic inputs for the value chain.

### **III- SKILL-MISMATCH AND OTHER CHALLENGES**

The structural and occupational effects are generating a skill-mismatch in the engineering and architecture professions. The following section will address the employability crisis and the major challenges for education and training systems in Lebanon.

#### **a) Future skills needed in a fluid and flexible work environment**

One of the first questions facing leading companies is related to the globalization of construction services: should do we centralize or decentralize?

In order to address this issue, every corporation should have a clear understanding of its division of the value chain between primary activities and support activities. The economic theory of the human capital shows that education, expertise, knowledge, skills (and more generally all human resources) do not have the same strategic value and impact, whether they are used in the internal employment mode (in the internal structure of the firm) or in the external work environment. Therefore, we need to distinguish between core and central competencies that are strategic for the efficient accomplishment of primary activities, and peripheral competencies and labor that might be subject to external contracts and outsourcing.

Most of the pioneering firms in the construction sector in Lebanon rely on well-known, confirmed and well-established professionals, and seem to pay higher salaries in order to attract the best skillful and loyal human resources for these types of employments: analyst, architect, civil-engineer, strategic planning, middle management, design engineers, mechanical engineer, and functional manager.

On the other hand, the peripheral jobs and competencies that are most subject to contractual employments or routine-based recruitments are: accountants, administrative positions, graphic designers, software engineers, technical jobs and other architectural services, programmers, maintenance, consultants, customer service agents, lawyers and trainers.

In the first category of employment, the core competencies are valuable and strategic for the firm due to their high potential of creativity and innovation. The employers are ready to keep their most skillful employees, to recruit professionals from rival firms by offering more tempting wages, and to invest in training and development of young engineers and architects for potential leadership positions.

In the second category, the tasks may be strategic to the firm but the peripheral competencies needed in each position have limited creativity. Skills are generic and transferable, and less subject to training and investment in human capital. Firms are inclined to short-term orientation in this employment mode, focusing on goals, productivity and lower wages, and they are more likely to recruit ready-made skillful labor (even at the cost of high turnover).

In conclusion, the globalization of construction services does not mean that partnerships, alliance and subcontracting are reducing the potentialities for promotion, loyalty, and career paths within the same company. Similarly, it does not mean that analytical skills and technical excellence are less important than before. It only shows that firms are facing an emerging challenge in identifying and keeping the most creative professionals who have the core competencies that are crucial to the development and to the competitiveness of the business. Thus, firms have to find balance between the internal need of investing in professionals in leading positions and the external need of subcontracting, decentralizing, or simply recruiting generic skills and substitutable labor.

Similarly, Higher Education Institutions (HEI) in Lebanon also have to evolve in a more globalized educational environment. However, the educational reforms in the private universities are slow, and currently they are only targeting the accreditation requirements rather than following a long-term strategy that takes into consideration the evolution of future jobs.

### **b) The skill-supply in Lebanon: the education reforms needed**

To analyze the skill-supply in the Lebanese construction sector, one should understand that the educational background of all professionals is regulated by the Order of architects and engineers and by major universities. HEI follow a 5 years program that combines Basic sciences, sciences of engineering, and specific subjects related to each specialty and sub-discipline. The programs are highly focused on analytical skills (such as applied math and sciences) and on modeling and simulating complex systems. The curricula emphasize on different basic creative skills, such as “generating new ideas” or new products and processes, “creating innovative concepts” and original works and projects, and “identifying new trends”.

When studying the specialized knowledge and skills in architecture and engineering programs, we may divide the competences framework into 5 major components:

- 1- Analytical knowledge and skills such as calculation, simulation and modeling.
- 2- Factual knowledge and skills that are required from architects and engineers for problem-solving.
- 3- Creative skills.
- 4- Computing skills.
- 5- Interpersonal and intercultural communication skills and attitudes.

The first two components are related to hard-skills and basic knowledge, thus they refer to standardized skills that are common to most graduates, leaving little room for uniqueness, originality and personal talent. These skills and knowledge have a more quantitative nature and they are more subject to objective assessment by teachers, instructors, and supervisors.

On the other way, the last three components are largely qualitative, and they are marginalized in the curricula (integrated into few courses and associated with other teaching objectives, receiving a small part in the teaching credits). These generic and soft components of the curricula are paradoxically the most needed in work environment and our methodology has showed that the demand for such skills and interpersonal attitudes will continue to shape the future of the profession. This skill mismatch needs to be addressed if freshly graduates are intended to succeed in their transition to the labor market and to be promoted to more creative and less routine jobs. Firms are seeking more proactive and creative graduates for leadership positions and tasks, and their limited (and oversaturated) need for analytical knowledge and skills is merely a matter of peripheral work that could be outsourced or easily substituted.

Unfortunately, HEI in Lebanon so far have only been successful in terms of forming standardized engineers and architects with solid analytical and factual knowledge, considering the above mentioned soft skills as merely supplements, as it may be seen in our study of employers perceptions. Table 6 shows for example that potential employers consider that freshly graduate engineers and architects lack soft skills (such as administrative skills) more than analytical skills.

Insufficient training	Lack of analytical skills	Lack of presentation skills	Lack of administrative skills	Insufficient knowledge of rules	Insufficient knowledge of markets needs	Lack of language mastering
59%	41%	35%	65%	58%	76%	41%

**Table 6- Lacking skills of freshly graduates - PACOME, 2015**

**HEI should integrate more creative design in their curricula and emphasize more on engineering creativity.** Indeed, 88% of the respondents in our survey considered design as the main task required from an engineer or an architect in Lebanon. We also found that creativity is the most important soft skill required from an architect (73% of the respondents). The evolutionary design and the formal design evaluation methods are for example still lacking in the Lebanese curricula, while considered as core skills of the profession. New competence frameworks should integrate routine design, with design engineering, and inventive design and inventive engineering.

HEI also need to revise their programs, in order to integrate computing and programming fundamentals, as well as the fundamental conceptual understanding of these creative tools and software. Students will be much better prepared for future creative jobs by learning programming and mastering other computer graphic software for 3D animation and design.

Finally, with the ongoing globalization of construction services, young engineers and architects need a better understanding of the global dimension of their actions. With the uprising integration with the Arab Labor market and the Gulf trend, their programs should emphasize more on the common cultural values and intercultural communication skills.

## CONCLUSION AND RECOMMENDATION

In conclusion, the global, regional and local need for better infrastructure will continue to drive demand for more creative and skilled architects and engineers in the coming years. More skilled professionals are required to conceptualize, design, and implement new projects within a rapidly changing social and political environment.

The key attributes that freshly graduates may lack on their first day of work are team building, strategic thinking, effective communication skills, ethics and respect for other collaborators from different cultural backgrounds. Our research indicates that these basic skill-shortages call for or a change in the education system that should be enhanced to include information, communication and language competencies.

The fast growth in demand over the medium term means that HEI need to form more competent architects and engineers, but this will also induce more needs for technical jobs in the construction sectors, especially, IT specialists, and specialist managers adapted to a more flexible and fluid organization of the work place. This requires more vocational and educational training, and accordingly, curricula should not only focus on analytical and technical skills, but also on communication, business management and marketing, in order to meet the employers' needs. A serious reform of educational programs should incorporate these new skills and competencies, such as creative thinking, creative design and creative engineering.

On the other hand, firms need to implement a proper wage policy, and a reward and incentive system, in order to achieve a good balance between investments in training in human capital and the employment policy for peripheral competences and labor. Therefore, our major recommendations are:

- 1) On the local level, firms and Higher Education Institutions (HEI) need to strengthen cooperation, for them to compete and survive in a highly integrated regional and global market.
- 2) Firms are shifting from a vertical organization to a more horizontal, fluid division of tasks. Consequently, skills that are largely needed are those are those that are most likely to reinforce coordination and trust among teams

within the internal components of the organization, and to deepen the cooperation with partners' networks.

- 3) HEI should incorporate in their curricula more creative courses and tools, such as creative design, computing and programming fundamentals, as well as courses related to globalization, with a specific emphasis on intercultural communication skills and attitudes.

A broader understanding of skills and core competencies will consist in the reconfiguration of the organization around emerging creative jobs as well as in the restructuring of the collaborative tasks among and within teams. Accordingly, firms should give more decision-making power to high potential workers capable of assuming more strategic responsibilities and to leave more space for genuine autonomy, responsibility, creativity and decision-making among their staff.



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