

# **ENGINEERING LOCAL JOBS: ELECTRO- MECHANICAL TRADES IN MOROCCO**

Silatech Discussion Paper Series  
January 2011

# FOREWORD

At Silatech, we believe in using knowledge to stimulate enterprise and employment opportunities for young people to support their advancement. Since our launch in 2008 by Her Highness Sheikha Mozah bint Nasser Al Missned of Qatar, Silatech's Board Chair, action-oriented analytics has driven much of Silatech's work.

In 2008, we launched the Silatech Index in partnership with Gallup, Inc. which captured the voice of young Arabs through face-to-face surveys of thousands of young people, and led to rich discussions with policy makers across the region. In 2009, we launched a collaborative research effort with the Brookings Institution, which led to a seminal study of social enterprise in the Arab world and a series of follow-on initiatives.

As 2010 comes to a close, I am delighted to introduce the Silatech Discussion Paper Series created under the leadership of Dr. Pawan G. Patil, Silatech's Chief Economist & Chief Economic Development Officer. These papers, written with partners, highlight a viewpoint or opportunity that we believe can achieve sustainable impact at scale. Written from a practitioner's perspective and informed by our experience and work, their purpose is to inform, provoke and enable action - supported by knowledge.

We are grateful to our partner, EMSI, in lending their expertise to help create the first several reports of the series. This first paper looks at Morocco's economic strategy and areas where skills shortages could create a bottleneck for growth. Drawing on publicly available data, the paper identifies a significant employment opportunity in engineering related electro-mechanical trades.

I hope you enjoy reading this report, and welcome your feedback.



**RICK LITTLE**  
Chief Executive Officer  
Silatech

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Morocco is working hard toward a vision of prosperity that includes a more diverse economy, greater access to education, and increased job opportunity for all citizens—including youth. This new prosperity is already being realized in some areas, but many more opportunities for growth remain.

This report is the culmination of much effort by EMSI and Silatech to assess Morocco's situation, assemble relevant data, and transform it into information. Throughout, Silatech's expertise and insight into issues surrounding policy and the mindset of Moroccan youth have been invaluable to this initiative.

We hope this research goes beyond 'data' and provides actionable information that will support policy and bring hope to current and future generations of Moroccan youth. It is great to be able to contribute towards thinking about solutions, not just problems, and we look forward to helping efforts that continue in doing so.



**ANDREW CRAPUCHETTES**  
Chief Executive Officer  
EMSI (Economic Modeling Specialists Inc.)

# INTRODUCTION

This study highlights areas where strategic investment in Morocco is likely to create jobs and have strong economic returns. Specifically, it focuses on targeted investment that would ease the burden on industry growth by producing resources currently imported from outside of Morocco. Morocco is keenly aware and proactively pursuing most of the areas where gaps in its economy exist. However, one area of opportunity is developing skilled human capital—many Moroccan industries have sought to make up for this shortage by importing skilled workers; other industries have not and are suffering as a result. Although Morocco has a large labor supply, much of it is unskilled. Moreover, for those with skills, there are often structural barriers to

enter the workforce. Across the economy, expertise is brought in from outside of the country, but nowhere is this more evident than in engineering.

In this study, we look at engineers and workers in electro-mechanical trades, which provide much of the work necessary to support newly built infrastructure. These occupation clusters are important to the economy and are promising targets for investments in training. In particular, electro-mechanical trades represent a short-term goal for people looking for work, while also being a first step toward a long-term goal of full engineering training because of a common base level of skills.



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*The authors would like to thank Mariam Guyer, Martin Roeske and Jo Aggarwal at Silatech for their reviews and comments on this paper, and the Director General of The National Agency for the Promotion of Employment and Skills (ANAPEC) in Morocco, Mr. Hafid Kamal, for his excellent feedback.*

## SUCSESSES AND CHALLENGES

In many ways, Morocco has been a recent economic development success story. The government has spearheaded corporate privatization and financial reforms, signed free trade agreements, created world-class seaports, aided the modernization of existing industries, expanded modern infrastructure, marketed and provided opportunities for offshoring, helped establish Morocco as a top global tourist destination, and encouraged a well-educated population. As a result of these investments and other reforms, Morocco has expanded output and seen an increase in employment in recent decades.

However, the nation faces some challenges:

- High government debt
- Individual tax rates of 40% on those earning more than US \$1550 per month
- High population growth
- Very low employment-to-population ratio of 46%
- Urban youth unemployment estimated as high as 33%

In addition, key sectors of the economy remain susceptible to outside forces:

- The agricultural sector accounts for approximately 45% of total employment but only 15% of GDP. In years with scant rainfall, GDP falls anywhere from 1% to 6%. In years of bumper crops, GDP increases by 1% to 4%.
- Tourism is expanding with construction of several high-end coastal resorts, but the sector has also been hit hard by economic downturns and creates low-skill, low-wage jobs.
- Morocco is the largest exporter of phosphorous and allied chemicals in the world, an activity which accounts for approximately 12% of all exports.
- The nation imports nearly 90% of its annual energy needs.
- The industrial sector accounts for 30% of GDP but only 20% of the workforce.

## FOCUS ON HIGH AND MIDDLE SKILLS

Low-skill workers are not considered in this report because from an industry perspective they are the easiest workers to hire. Middle- and high-skill workers are much harder to come by because they need to have specific skills that are not in large supply. With low-skill workers, an efficient worker may be twice as productive as an inefficient one, but with middle- and high-skill workers, efficient workers may be five or ten times more productive.

Industry success relies on the smaller group of skilled workers performing their jobs well, which drives the output of the industry as a whole. When industries cannot find high-quality workers, they have three options: a) import labor, b) hire workers of lesser quality who will hurt performance, or c) not hire at all. Industries in this position also will have fewer low-skill workers, as industry growth and capacity are directly impacted by a lack of skilled workers. Lifting constraints, then, on middle- and high-skill workers opens doors for low-skill workers.

# OBJECTIVES

There are two primary objectives of this report: 1) identify a promising target for training investment within Morocco, and 2) provide a workflow that can be used to link whole-economy views of a country to specific training needs that require attention.

## FRAMEWORK

When looking for training opportunities, analysis too often begins by identifying companies that cannot find suitable workers. While this step is necessary when designing training that fits the needs of the economy, it should not be the first step. There are too many companies, too many industries, and too many skills needs for all of them to be met. Rather, the first step should be identifying where training will do the most good, not only for a particular company but for the entire economy. This allows key industries to be targeted rather than industries that are the most vocal about their training needs.

Once high-priority industries are picked, staffing can be analyzed to identify common sets of occupations within them. With occupation groups identified, it must be determined if current training is adequate for supplying workers for those occupations. Occupation groups where demand is outpacing supply can then be broken down into the skills that underlie them, and training options considered that will address the specific skill gaps.<sup>1</sup>

“When looking for training opportunities, analysis too often begins by identifying companies that cannot find suitable workers.”

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<sup>1</sup> Note: Analysis can only go so far. After occupation and skill targets are identified, much groundwork must be done to find specific companies, training providers, an appropriate curriculum, etc. However, this work can be done more confidently having already established the economic significance of the industries and occupations for which training is targeted.

# INDUSTRY SUMMARY

Morocco does not have petroleum reserves driving its economy like other MENA region countries, instead relying on a mix of industries to employ its more than 10 million workers. It has been proactive in providing incentives to help bring industries to the country. Sectors that have been particularly targeted are tourism, offshoring, phosphate mining and processing, energy, micro/nanotechnology, agriculture/seafood processing, and textiles. Because of the strength of current industrial investment, this report focuses on labor requirements for a selected subset of industries, rather than trying to identify new targets for industrial investment.

To be considered for this report, industries had to at least be complementary to, if not directly included in, current Moroccan investment (e.g., while construction is not one of the primary target areas for Moroccan investment, its presence is necessary for building the infrastructure for many of the investment areas).

## TARGETED INVESTMENT: TRAINING

Where would additional Moroccan investment create the best jobs? Data and skills analysis suggest there is an unmet need for skilled human capital. Particularly striking is the number of foreign firms performing engineering work in Morocco. Indeed, the need for engineers is evident across the economy considering they make up a low percentage of the workforce and there are indications that current engineering training initiatives are not fully effective.

Emerging as a counterpoint is the need for workers who are able to deal with the interface of electrical, mechanical, and computer-based systems. Partly driven by the rapid spread of technology and partly

by structural changes in industry, electro-mechanical trades have surfaced as a necessary addition to the modernization of Morocco. Training in these two areas is import substitution of human capital—currently much of the skilled labor in Morocco is imported from out of country.

OCCUPATION CLUSTERS	
<b>ENGINEERING CLUSTER:</b>	
Computer Software Engineers, Applications	Offshoring
Computer Systems Engineers/Architects	Offshoring
Civil Engineers	Construction/Energy
Electrical Engineers	Construction/Energy/ Electronic Component Mfg.
Mechanical Engineers	Construction/Energy
<b>ELECTRO-MECHANICAL TRADES CLUSTER:</b>	
Electricians	Construction/Energy
Industrial Machinery Mechanics	Energy/Textiles/Electronic Component Mfg.
Machinists	Electronic Component Mfg.
Electrical Power-Line Installers and Repairers	Energy (includes Wind Turbine tech)
Mechatronics Technicians	Textiles/Electronic Component Mfg.

## FOCUS INDUSTRIES

This report focuses on the construction engineering, offshoring, energy, textile manufacturing, and electric/electronic component manufacturing industries.<sup>2</sup> Some qualify as up-and-comers, some are mainstays, others are necessary for greater economic growth across all sectors, but all have one thing in common: a significant need for skilled workers in order for them to flourish.

**Construction:** The many infrastructure and building projects ongoing and the number of international engineering firms working in Morocco both indicate a strong demand for more engineers in this sector.

**Offshoring:** Morocco claims a linguistic and geographic advantage for offshoring in France and Spain. However, as offshoring is broadening from simple call-centers into more technical functions, the demand for qualified programmers and software engineers is outpacing supply.

**Energy:** The overwhelming majority of Morocco's energy inputs come from outside the country.

Significant, ongoing investments in this area will generate the need for a huge number of middle-skilled workers. Particularly, this will register as a need for technicians to maintain the significant infrastructure of new wind farms.

**Textile Manufacturing:** Morocco boasts a huge presence in European textile markets, but recent changes in trade regulation have resulted in industry decline. To come out of decline the sector needs significant infrastructure, and consequently occupational, improvements. These changes should gear the textile sector towards quick turnaround to markets.

**Electric/Electronic Component Manufacturing:** This industry has been a rising star in the export sector, seeing rapid expansion within the last few years in the assembly of simple electric and electronic devices, such as wires and batteries. If the trend continues, and higher level components are manufactured, an increasing share of engineers for design work as well as technicians for maintaining factory operations are needed.

INDUSTRY	IMPORT/EXPORT	ENGINEERS NEEDED	ELECTRO-MECHANICAL TRADES NEEDED
Construction Engineering	Service Import	Yes	Yes
Offshoring	Service Export	Yes	No
Energy	Commodity Import	Yes	Yes
Textile Manufacturing	Commodity Export	No	Yes
Electric/Electronic Component Mfg.	Commodity Export	Yes	Yes

<sup>2</sup> See the appendix for detailed descriptions and data on these industries.

# OCCUPATION CLUSTERS

Across the focus industries, our research indicated that demand for two particular sets of occupations was constant. Physical engineers were needed in energy and construction. Computer engineers were needed for offshoring. Electro-mechanical trades are emerging across manufacturing and energy. While demand was present, it was also evident that it was not met.

The engineering cluster consists of civil, electrical, and mechanical engineering, as well as systems/software architects and programmers. The electro-mechanical trades cluster contains electricians, line installers and repairers, machinists, mechatronics technicians, and industrial machinery repairers.

## FORMING THE CLUSTERS

The occupation clusters were formed based on two criteria: similarity of level of education, and similarity of the skill 'shape' underlying the occupations. Overall, the skill shapes of the electro-mechanical trades occupations are more similar to each other than the skill shapes of the engineering clusters, but there is significant enough overlap within the cluster to consider them as a group.

The skills 'shape' of occupations not only allows them to be clustered according to skills but also to see where common levels of skills might allow for common training. For example, within the electro-mechanical trades cluster, we see strong similarities between the occupations in 'Mechanical', 'Engineering and Technology', 'Mathematics', and 'Design' (see next page)s. On the other hand, we see strong differences in 'Building and Construction' and 'Production and Processing'. The similarities show that these occupations are definitely related

(and workers could probably move between them with minor retraining) and point to the possibility of common training.

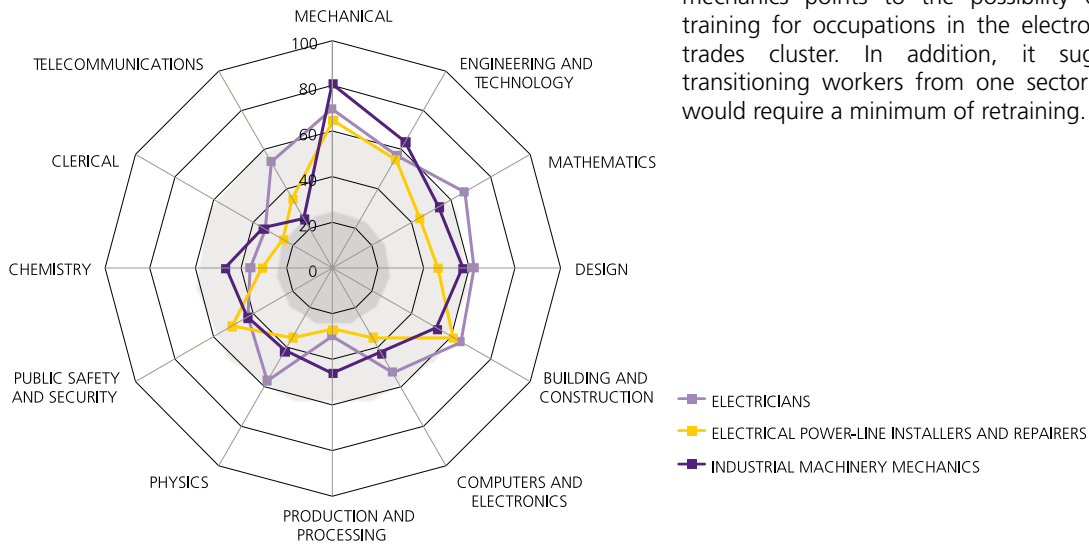
## SKILL AND CROSS-OCCUPATIONAL DESCRIPTION

Being able to do cross-occupational skill analysis is a relatively new phenomenon. Using information from the Occupational Information Network (O\*NET),<sup>3</sup> we can analyze similarities and divergences of the competencies that underlie occupations. In our research, we selected ten particular knowledge descriptors from the O\*NET database to compare across the occupation clusters.

<sup>3</sup> O\*NET was developed under the aegis of the US Department of Labor/Employment and Training Administration (USDOL/ETA), and is a system of occupational description, including quantitative descriptors of cross-occupational competencies.



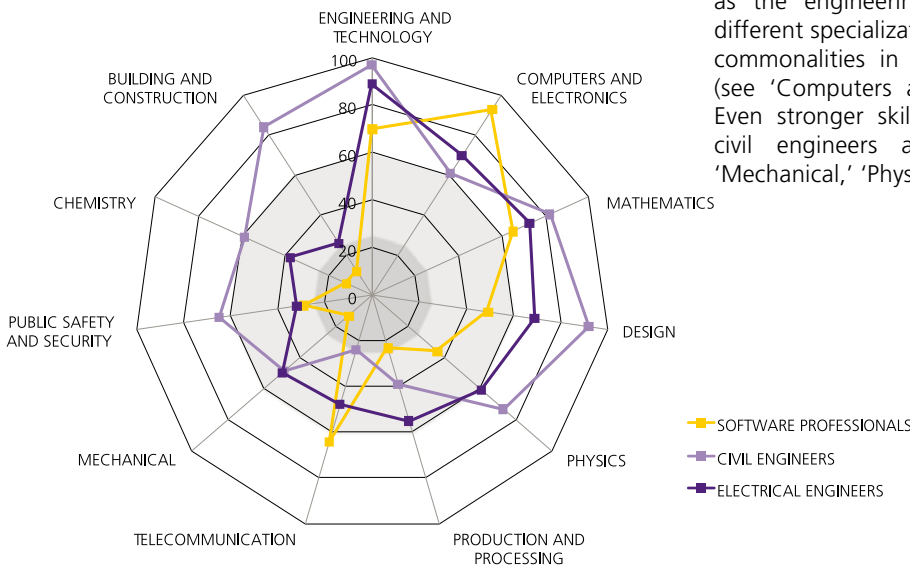
### SELECTED ELECTRO-MECHANICAL TRADES SKILLS



The similarity of the underlying skill 'shapes' of electricians, line installers, and industrial machinery mechanics points to the possibility of common training for occupations in the electro-mechanical trades cluster. In addition, it suggests that transitioning workers from one sector to another would require a minimum of retraining.

Source: Silatech-EMSI Analysis

### SELECTED ENGINEERING SKILLS



The skills underlying the engineering cluster are more varied than those in the electro-mechanical trades, as the engineering disciplines considered have different specialization. However, there are definite commonalities in some areas across the cluster (see 'Computers and Electronics', 'Mathematics'). Even stronger skill commonalities exist between civil engineers and electrical engineers (see 'Mechanical,' 'Physics').

Source: Silatech-EMSI Analysis

# ENGINEERS: FILLING MOROCCO'S GAP

The Moroccan economy has expanded dramatically over the course of the last decade, and now is prepared to exploit opportunities that would have been impossible even five years ago. Fast economic growth, however, brings with it its own set of challenges, and equipping a workforce with necessary skills is critical for ongoing growth. In Morocco's case, a consideration of several of its important industries points to a gap that needs to be filled: engineers. Less than 1% of Morocco's labor force is made up of engineers, as compared to the US or UK, where engineers make up about 3% of the labor force.

Engineers are needed in Morocco as a substitute for imported services: much of the engineering work on infrastructure in Morocco is done by firms located outside of Morocco. Engineers are also needed as a service export: IT offshoring is growing, but wages are being driven up for IT professionals as demand exceeds supply. Demand for engineering is being felt across multiple sectors and across multiple disciplines.

The Moroccan government is aware of these needs and has put in place an initiative '10,000 Engineers' in an attempt to address some of this shortfall. However, anecdotal evidence suggests that despite the initiative, the supply of graduates in the engineering field is not matched with the demand of the economy—reports of graduates unable to find work coincide with reports of the recruitment of Moroccan expatriates to return and fill vacant IT positions lacking suitable candidates.

The effect of the dearth of engineers in the Moroccan economy extends far beyond the engineer's salaries: In offshoring, as demand for

skilled workers outpaces supply, and costs rise, Morocco becomes a less competitive offshore option. In physical engineering, not only does money leak out of the country, but the innovation and entrepreneurship made possible by the presence of skilled technical professionals is also lost.

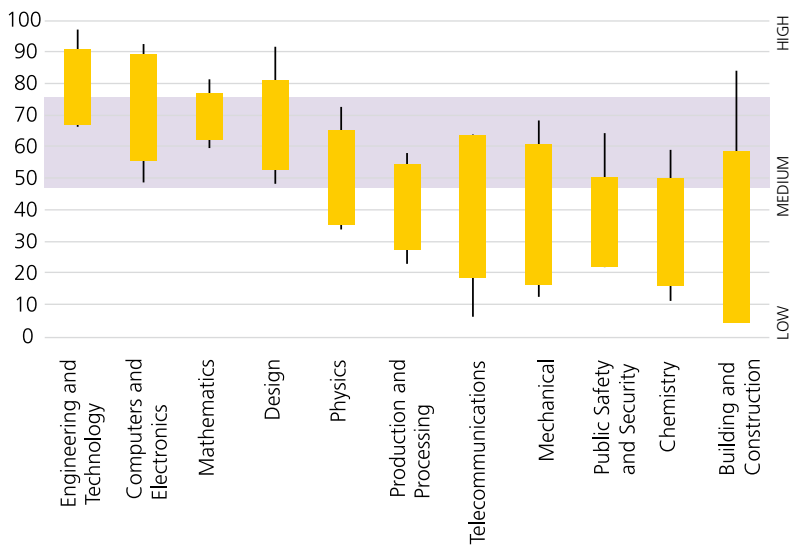
Identifying and correcting the causes of the disconnect between the academic training of engineers and their employment within industry should be a matter of first importance for Morocco.

## SKILLS

Despite the differences that exist between engineering occupations (particularly between software development occupations and the physical engineering occupations), there remains a group of similar skills ('Engineering and Technology', 'Computers and Electronics', 'Mathematics', 'Design'). The more specialized a discipline is, the more training has to be specialized for that particular discipline, but much of the requisite core of skills that the specialization rests upon is commonly held.

ENGINEERS	SECTOR
Computer Software Engineers, Applications	Offshoring
Computer Systems Engineers/ Architects	Offshoring
Civil Engineers	Construction / Energy
Electrical Engineers	Construction / Energy
Mechanical Engineers	Construction / Energy

## ENGINEERING CLUSTER SKILL LEVEL RANGES



The engineering cluster occupations, while having variations in the type of skill required, still have a similar 'shape' as a basis. Moving from left to right on the graph, the levels slope downwards as whole, pointing to a core of skills which underlie the cluster as a whole.

Skill ranges show both general levels of skills within the occupation cluster as well as the degree of skill variation between the occupations. Skills are scored on a 0-100 scale. Levels 0-30 (LOW) require little or no specialized training, levels 30-60 (MEDIUM) require some specialized training, while levels 60 and higher require extensive specialized training.

Source: Silatech-EMSI Analysis

SKILL AREA	AVERAGE LEVEL	COMPUTER SYSTEMS ENGINEERS/ ARCHITECTS				
		COMPUTER SOFTWARE ENGINEERS	CIVIL ENGINEERS	ELECTRICAL ENGINEERS	MECHANICAL ENGINEERS	
Engineering and Technology	79	70	73	97	89	67
Computers and Electronics	73	93	90	61	70	49
Mathematics	70	65	70	82	73	60
Design	67	49	60	92	69	66
Physics	50	36	34	73	61	48
Production and Processing	41	23	31	39	55	58
Telecommunications	41	64	63	24	48	7
Mechanical	39	13	13	49	50	69
Public Safety and Security	36	29	30	65	32	27
Chemistry	33	12	18	59	38	40
Building and Construction	32	12	10	84	26	27

# ELECTRO-MECHANICAL TRADES CLUSTER:

## MIDDLE SKILLS FOR THE EMERGING ECONOMY

As the information era comes of age, shifts within required workforce skills are to be expected. One such shift that Morocco should address is the integration of mechanical, electrical, and programming skills throughout the industrial and energy sectors. Wind turbine technicians are an example of this intersection within energy—maintaining and repairing wind turbines requires a working knowledge of electrical, mechanical, and hydraulics systems, as well as the computer systems that control them. The same skills are also seen on the factory floor, as the machines that automate the production process become more integrated with computer systems. As Morocco seeks to maintain and improve its position within the world economy, the modernization within industry and energy will lean toward this synthesis of disciplines.

Within power generation, this sort of training will be represented by wind turbine technicians and solar thermal technicians, and within manufacturing by mechatronics technicians (manufacturing machine operators/troubleshooters/programmers).

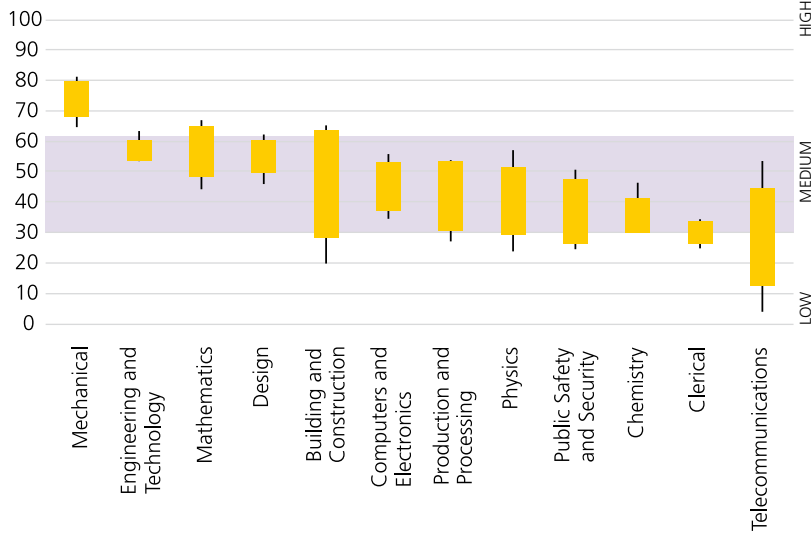
Training for this emerging need could lead to a technically skilled workforce flexible enough to move from one occupation to another with minimal retraining.

### SKILLS ANALYSIS

The skills match between these occupations is very tight, with the largest disparities coming where the categories are more industry-specific ('Building and Construction', 'Production and Processing', and 'Telecommunications'.) Those skill categories where the skills are more cross-industrial have a much tighter match ('Mechanical, 'Engineering and Technology', 'Mathematics', and 'Design'). Even though the specifics of the knowledge within the categories will differ (i.e., the types of mathematics applied by electricians as opposed to machinists), the core competency is very similar.

TRADES	SECTOR
Electricians	Energy / Construction
Industrial Machinery Mechanics	Energy / Textiles / Electronic Component Manufacturing
Machinists	Electric / Electronic Component Manufacturing
Electrical Power-Line Installers and Repairers	Energy
Mechatronics Technicians	Textiles/ Electronic Component Manufacturing

### ELECTRO-MECHANICAL SKILL LEVEL RANGES



As the graph to the left shows, all of the electro-mechanical trade occupations require high skill levels in 'Mechanical', 'Engineering', and 'Mathematics', and 'Design'. These commonly held skills could form the basis of common training across the occupations, while skills that have more variation (such as 'Building and Construction') would need training more specific to each occupation.

Skill ranges show both general levels of skills within the occupation cluster as well as the degree of skill variation between the occupations. Skills are scored on a 0-100 scale. Levels 0-30 (LOW) require little or no specialized training, levels 30-60 (MEDIUM) require some specialized training, while levels 60 and higher require extensive specialized training.

Source: Silatech-EMSI Analysis

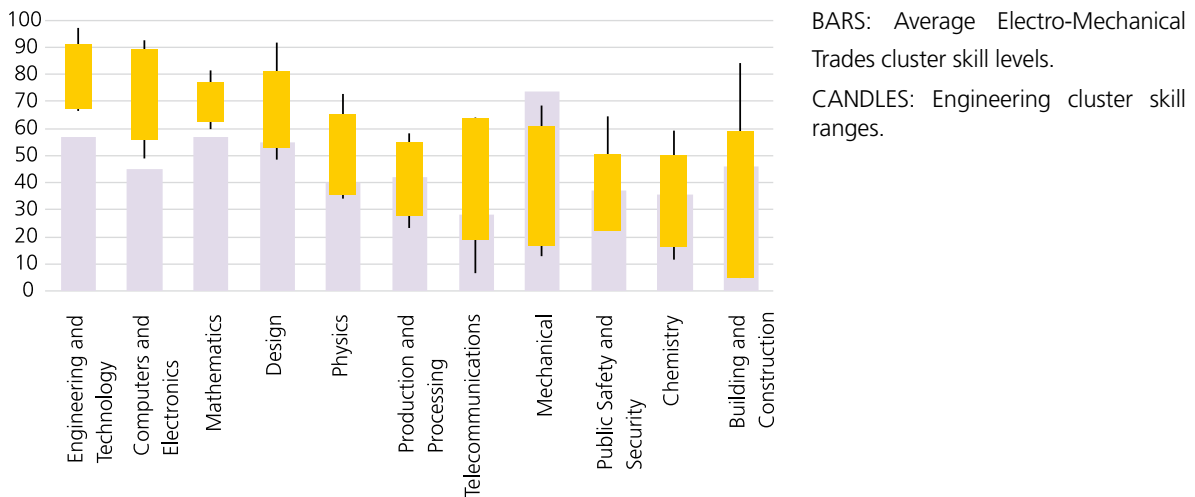
SKILL AREA	AVERAGE LEVEL	ELECTRICAL POWER-LINE INSTALLERS				
		ELECTRICIANS	INDUSTRIAL MACHINERY MECHANICS	AND REPAIRERS	MACHINISTS	MECHATRONICS
Mechanical	74	70	81	65	77	77
Engineering and Technology	57	57	64	55	55	55
Mathematics	57	67	54	44	65	54
Design	55	62	57	46	55	55
Building and Construction	46	65	53	61	20	31
Computers and Electronics	45	53	43	35	40	56
Production and Processing	42	30	46	27	54	54
Physics	41	57	42	35	24	45
Public Safety and Security	37	43	43	51	25	25
Chemistry	36	36	47	31	33	33
Clerical	30	34	35	25	29	29
Telecommunications	29	54	25	35	4	25

# CONCLUSIONS

## A FIRST STEP TOWARD ENGINEERING

There is a strong connection between the overall 'shape' of the electro-mechanical trades cluster to the 'shape' of the engineering cluster (see below). Even though the electro-mechanical trades have lower scores overall, the same sorts of skills are the basis of both clusters. This skill similarity suggests that training for the electro-mechanical trades might also be a first step for entering into the engineering disciplines. Much work would have to be done to determine what would be necessary for this sort of transition, but it has the possibility for bringing youth and underserved populations into the professional world via vocational training.

### AVERAGE ELECTRO-MECHANICAL TRADES CLUSTER SKILL LEVELS VS. ENGINEERING CLUSTER SKILL LEVEL RANGES



Source: Silatech-EMSI Analysis

# IMPLICATIONS

## FREEING INDUSTRY

More than 25% of firms in the MENA region have cited a lack of skills as a constraint on the growth of their company.<sup>1</sup> This is particularly true of Morocco. Until training supplies Morocco with qualified engineers and competent middle-skill workers, this deficit will limit Morocco's potential. Not only will money leak out of the economy as companies seek in-demand skills outside of the country, but Morocco will also appear less attractive to business. If companies cannot fill key occupations in the region or only fill them at a high price, locating in Morocco becomes less likely. Morocco has begun efforts to correct this problem, but the gap between training and employment must be filled for the country's full potential to be realized.

## ELECTRO-MECHANICAL TRADES: VERSATILE TRAINING

In the world economy, volatility within industry is the norm. As such, training workers for a wide range of industries becomes a valuable asset not only to them, but to the economy as a whole. When skill limitations do not silo workers into a single position, they can fill in-demand occupations with minimal retraining.

## OVERLAPS IN TRAINING

As research uncovers a common skill base between electro-mechanical trades and engineering, training providers should explore using electro-mechanical training as a basis for disadvantaged youth to enter into engineering training. Not only does it provide a solid base for immediate employment, it also provides a springboard to move up into professional training.

## SMALL AND MEDIUM ENTERPRISES

There is a strong possibility of starting small and medium enterprises with the skills obtained in training for occupations we have considered. Engineers have many consulting opportunities (either in computer or physical engineering), which may lead to the establishment of new firms. Workers in electro-mechanical trades have potential for founding their own domestic electrician/auto mechanic/industrial repair companies.

“More than 25% of firms in the MENA region have cited a lack of skills as a constraint on the growth of their company.”

<sup>1</sup> “Missed by the Boom, Hurt by the Bust” (Middle East Youth Initiative). May 2009.

# NEXT STEPS

## **FIND THE PROBLEM WITH ENGINEERING INITIATIVES**

Morocco has not ignored the urgent need for engineers, and yet the programs have not yielded the expected results. If the country decides to pursue this targeted area, they must discover what underlies that failure—whether it is lack of funding, an employment structure problem (such as hiring or firing practices), or a particular skill deficiency in the graduates that are produced. Fixing the problem would likely be more cost-effective than trying to start a new initiative.

## **EXPLORE ELECTRO-MECHANICAL TRADES**

There is still much work to be done to determine the skill overlap among the electro-mechanical trades and tailor the training to fit with the current demands of companies. Current vocational training should also be reviewed to discover if overlaps in skills training could be used to combine and strengthen multiple initiatives.

## **EXPLORE THE USE OF SKILLS ANALYSIS**

Skills analysis is still in its infancy, but can potentially make connections between training and occupations that would otherwise remain hidden. This analysis also allows researchers to cluster occupations based on skill requirements, rather than simply the industry they serve or the type of material they use. Skills analysis could play a vital role in providing connections between workers and enterprises via focused training that meets the specific needs of the workforce while maintaining broad applicability across industries and occupations.

## **A NEED FOR ACCESSIBLE, STANDARDIZED DATA**

This analysis was a long, intense process made more difficult by working with disparate, non-standard data sources. The current process of combining and cross-checking multiple sources of information and general collation and data-cleaning is not optimal for making informed investment decisions. To make wise investments in the MENA region, expanded access to data is not a luxury—it is a necessity.

We also can't overstate the value of confidence in the data. This provides assurance that there is not a missing piece that could drastically influence an investment decision if it were known. Confidence in the data means better and faster analysis, leading to better decisions and better outcomes.



# APPENDIX



The following is a breakdown of five key Moroccan industries, with a discussion of their employment/imports and demand for engineering and electro-mechanical trades.

**ENERGY**  
**CONSTRUCTION**  
**OFFSHORING**  
**TEXTILES**  
**ELECTRIC AND ELECTRONIC COMPONENT MFG.**

# ENERGY

## BACKGROUND

Energy input costs are referred to as the “cruellest tax of all” since energy is a necessary input to the production of all businesses and households, and energy costs impact all businesses and all households. Morocco has few proven hydrocarbon reserves, which make it the largest importer of hydrocarbons in the MENA region. Recent discoveries off the coast of southern neighbor Mauritania may hold promise for Morocco, but even if reserves were to be found, benefits would not be seen for many years.

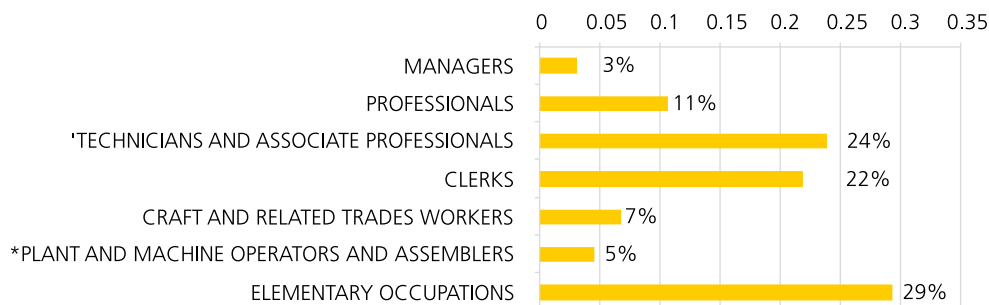
Electricity demand is expanding from 5% to 8% annually due to strong economic growth, causing sporadic outages. Demand is met largely through coal-fired power plants. Hydroelectric, solar, wind, geothermic, and natural gas generation comprise the remaining sources. Nuclear generation is of interest but nowhere near becoming a reality. Morocco is in the process of integrating its electrical grid with the EU market and some of its eastern MENA neighbors.

Since domestic sources only supply about 10% of total energy demand—and the population and economy are growing—the Moroccan government has launched initiatives to increase domestic supplies. The expansion of this sector is critical to further growth across the whole Moroccan economy.

## IMPORTS AND EMPLOYMENT

The cost of importing energy and lubricant products increased dramatically between 2005-2008. Despite the amount being imported remaining fairly static, the cost almost doubled during that period. In-sector employment has remained level (around 40,000 workers) but much of current investment in the energy sector has created jobs in construction rather than energy. New power plant construction and rural electrification fall into this category.

## ENERGY STAFFING



**ENGINEERING DEMAND**

Engineering demand within energy is driven by new infrastructure projects (power plants and wind farms). Much of the demand overlaps with the demand for engineers within construction, and like the construction sector, much of the engineering work leaves the country. Projects such as the Ain Beni Mathar thermo-solar power plant (Spain’s Abener) and the Tanger Wind Farm (Spain’s Gamesa Eolica) are being engineered and built by foreign firms.

**ELECTRO-MECHANICAL TRADES DEMAND**

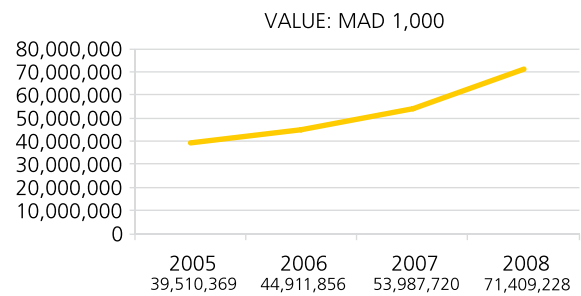
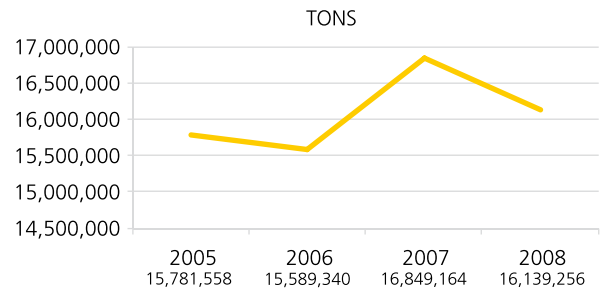
Two separate projects currently underway in Morocco suggest the need for more workers in electro-mechanical trades (for line installers and wind turbine technicians in particular). The first need is continued investment in infrastructure for rural electrification. More power lines installed will lead to increased demand for workers to maintain the infrastructure, as well as electricians to connect into the newly established power grid. The second is the heavy investment in wind power as part of the “1000 MW Initiative.” With new wind farms coming online in a regular succession, wind turbine technicians will be needed for maintaining and repairing the turbines, requiring skills that span electrical, mechanical, and programming disciplines.

WIND FARM	OUTPUT	COMMISSIONING
Amogdoul	60 MW	2007
Tanger	140 MW	2009
Tarfaya	200 MW	2011

**ENERGY, GAS, AND WATER SUPPLY EMPLOYMENT**

2007 Employment	2007 GDP (million dh)	2007 % of GDP
39,372	15,749	2.56%

**IMPORTS: ENERGY AND LUBRICANTS**



**MULTIPLIERS**

	SALES	JOBS	EARNINGS
Energy, Gas, and Water Supply	1.77	1.99	2.38

Source: Silatech-EMSI Analysis

# CONSTRUCTION

## BACKGROUND

Economic growth and government initiatives aimed at infrastructure expansions and improvements have caused the proliferation of construction projects across Morocco, creating a robust construction sector. However, Morocco has a very small percentage of engineers within construction compared to developed countries, and is an importer of engineering services (particularly on large projects). Import substitution through training more civil engineers and fostering engineering firms will not only prevent the leakage of money from the economy, but provide Morocco with a base of skilled professionals for service exports to Europe and the MENA region.

## EMPLOYMENT

Construction employment grew by more than 100,000 jobs from 2006-2008. It is the fastest-growing sector of the economy in number of jobs, and is the third fastest-growing sector by percent after 'Mining and quarrying' and 'Financial intermediation; Real estate, renting and business activities.'

CONSTRUCTION EMPLOYMENT		
2006	2007	2008
791,126	841,275	905,593

## ENGINEERING DEMAND

Demand for engineers will move along with the growth of construction as whole. However, growth is also demanded by the staffing of construction as well. Morocco has four times fewer engineers as part of their construction workforce than the US does, and nine times fewer than the UK. With this

combination, the unmet demand for engineers in Morocco shows why many projects are given to foreign engineering firms.

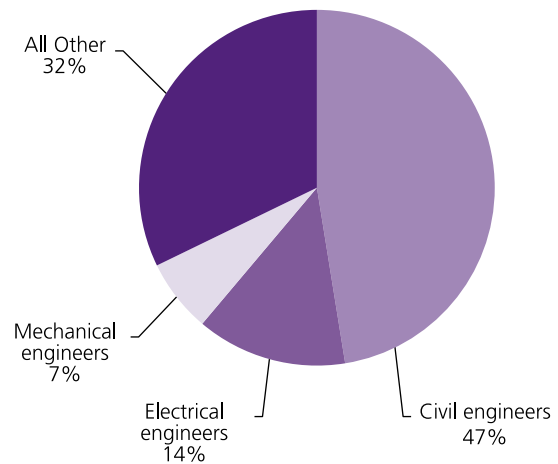
In order for Morocco to reach the same percentage of engineers within construction as the US, it will need about 24,000 more engineers working in construction.

### STAFFING BY ENGINEERING DISCIPLINE(US)

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#### CONSTRUCTION STAFFING SIMILAR TO THE US: BY ENGINEERING DISCIPLINE

Civil engineers	47%	11,390
Electrical engineers	14%	3,285
Mechanical engineers	7%	1,598
All Other	32%	7,727
Total:	100%	24,000



Source: Silatech-EMSI Analysis

## CONSTRUCTION INDUSTRY EMPLOYMENT

2007 Employment	2007 GDP (million dh)	2007 % of GDP
841,275	37,233	6.04%

## CONSTRUCTION/INFRASTRUCTURE PROJECTS ENGINEERED BY FOREIGN FIRMS

The larger the scale of the project, the more likely that international corporations will be called in. Below are a few projects being engineered by foreign firms.

PROJECT	COMPANY	NATIONALITY
Casablanca Mall	Arup	United States
Tangier Med 2	Bouygues Construction,	France
Agadir Reservoir	NJS	Japan

## MULTIPLIERS

	JOBS	EARNINGS
Residential building	1.51	1.22
Industrial building construction	1.11	1.05
Commercial building construction	1.38	1.17

# OFFSHORING

## BACKGROUND

Offshoring is viewed as one of the largest engines of economic and job growth in Morocco. As a central theme in Plan Emergence, officials predict offshoring may add up to 15% to GDP and 100,000 direct jobs. Geographically, strong demand for employees comes from the establishment of new offshoring business parks in Casablanca and Rabat. "Casanearshore" and "Rabat Technopolis" will soon be joined by two similar offshoring centers in Tangier and Fez.

Dozens of European firms have already signed leases and are looking to hire.

A growing demand for IT offshoring is creating upward pressure on IT engineers wages, and even moving companies to seek expatriate Moroccans in an effort to fill positions. While the government has tried to be proactive in training engineers for these positions, the unfilled demand points toward the need for a more concentrated and effective focus on training IT professionals. If Morocco wants to keep its competitive position in offshore work (particularly for France and Spain), trained professionals in IT are a must.

## RABAT TECHNOPOLIS

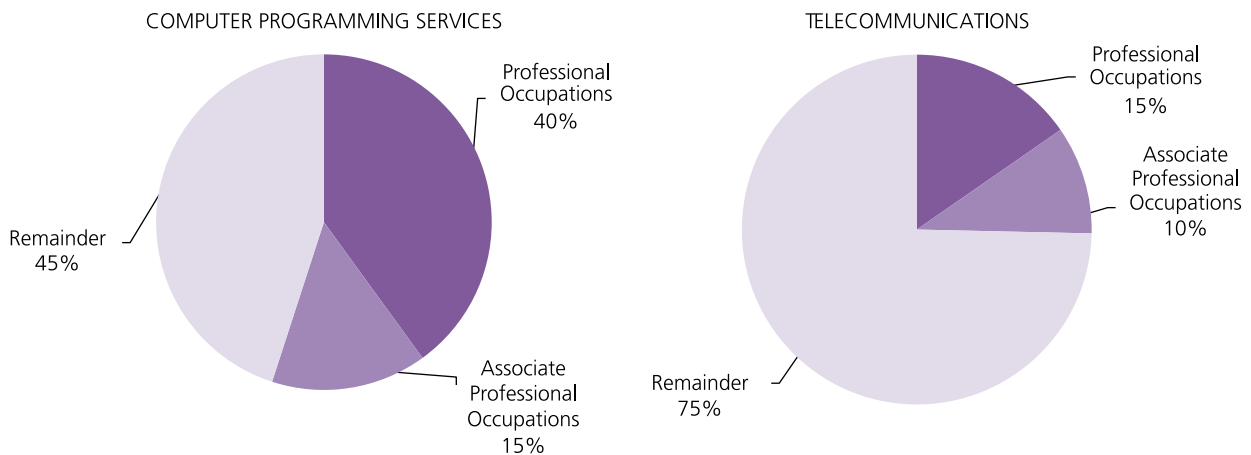
The Rabat Technopolis is specifically geared toward attracting IT offshoring. The goal is to create 12,000 - 15,000 jobs in ITO/KPO by 2016. The infrastructure and investment incentives are being put in place to attract high tech companies from across the world. In this and other offshoring center projects, Morocco is building the need for a highly trained, highly qualified workforce.

## TELECOMMUNICATIONS OFFSHORING VS. IT OFFSHORING STAFFING REQUIREMENTS

IT staffing is quite different than telecommunications staffing. In telecommunications, only 15% of the workers require a professional level of qualification, compared to 40% in IT. This means 250 more professionals are required per 1,000 workers hired in IT compared to telecommunications (primarily programmers and software architects.) Call centers have created the bulk of offshoring jobs in Morocco, but expansion into other forms of offshoring will not happen in a meaningful way if the skills required do not exist in the workforce.

### IT OUTSOURCING: HIGHER TRAINING REQUIREMENTS

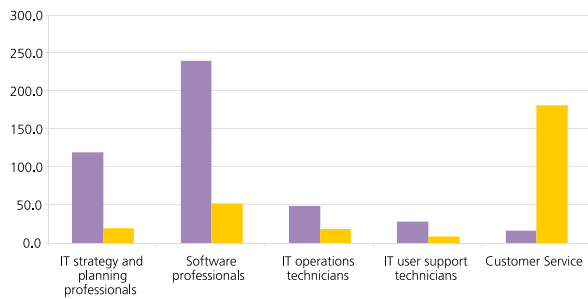
IT outsourcing is weathering the recession better than its counterparts in BPO. However, IT requires much higher skill inputs, relative to Telecommunications.



## IT STAFFING: SELECTED IT OCCUPATIONS PER 1,000 IN EMPLOYMENT

### COMPUTER PROGRAMMING SERVICES TELECOMMUNICATIONS

IT strategy and planning professionals	120	IT strategy and planning professionals	20
Software professionals	241	Software professionals	52
IT operations techs	49	IT operations techs	19
IT user support techs	29	IT user support techs	9
Customer Service	17	Customer Service	182

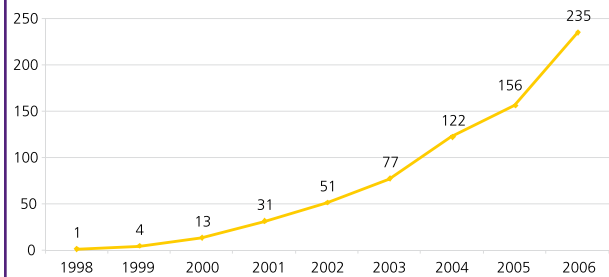


Source: Silatech-EMSI Analysis

## STRENGTH IN CALL CENTERS

	2004	2006
Number of call centres (declaration)	50	180
Number of call centres in operation	50	143
Number of positions	4,400	14,700
Average size (position/CC)	88	114
Employees	5,500	17,500
Turnover (Million US\$)	97.6	346

### CALL CENTER DECLARATIONS



## MULTIPLIERS

	SALES	JOBS	EARNINGS
ITO	1.64	1.52	1.93
Call Centers	1.48	1.53	1.19
BPO	1.47	1.71	1.25

# TEXTILES

## BACKGROUND

The textile industry employs roughly 200,000—or about 40% of the industrial workforce—and exports nearly US \$3.7 billion in basic textiles and ready-to-wear clothing to the EU, US, and Turkey, among others. While exports have increased nearly 200% during the last decade, output likely would have been much higher if not for the expiration of the Multi-Fibre Agreement in 2005. This 30-year global agreement placed quotas on imports from lower-wage producers into developed countries to allow the textile industries in developed countries to adapt. Morocco still enjoys a geographic advantage for EU exports over Asian exporters, and large modernized textile mills still retain cost advantages for certain products.

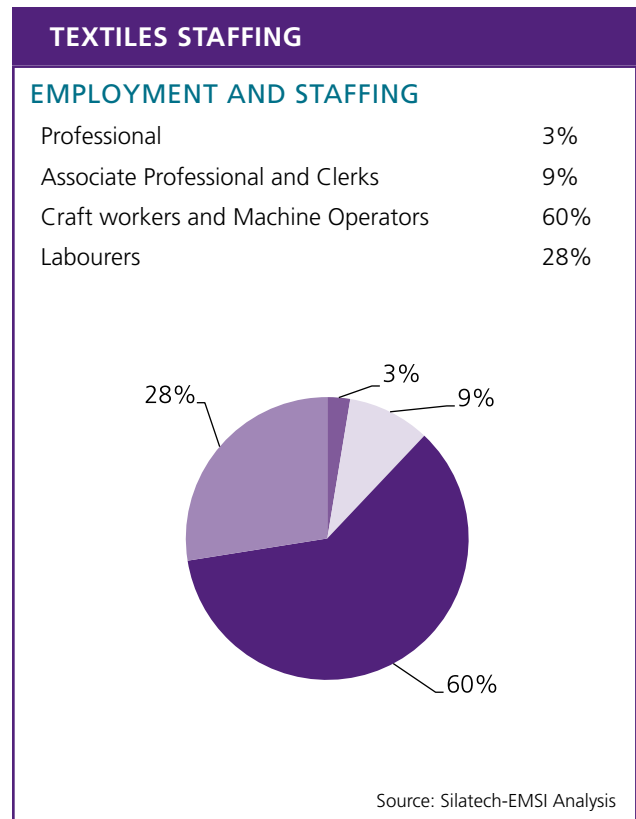
However, the Moroccan textile industry is also comprised of many small, older mills that employ a significant share of the textile workforce. As these smaller firms face increasing competition from abroad, either new niche markets must be found or the small firms consolidated to avert large

layoffs. Increasingly sophisticated technology within this sector will drive demand for workers capable of interfacing with sewing machines connected with computerized systems. As with other manufacturing sectors, cross-disciplinary workers are becoming a necessity.

## EXPORTS AND EMPLOYMENT

Exports have been in decline since 2006, both in terms of tonnage and sales. Partially a result of the global downturn (especially in the consumer markets in the EU and the US), the decline is driven by the downturn and increased competition from Asian markets. There was a small employment decline from 2007 to 2008 (596,000 to 563,000), and a job loss is expected in 2009 as well.

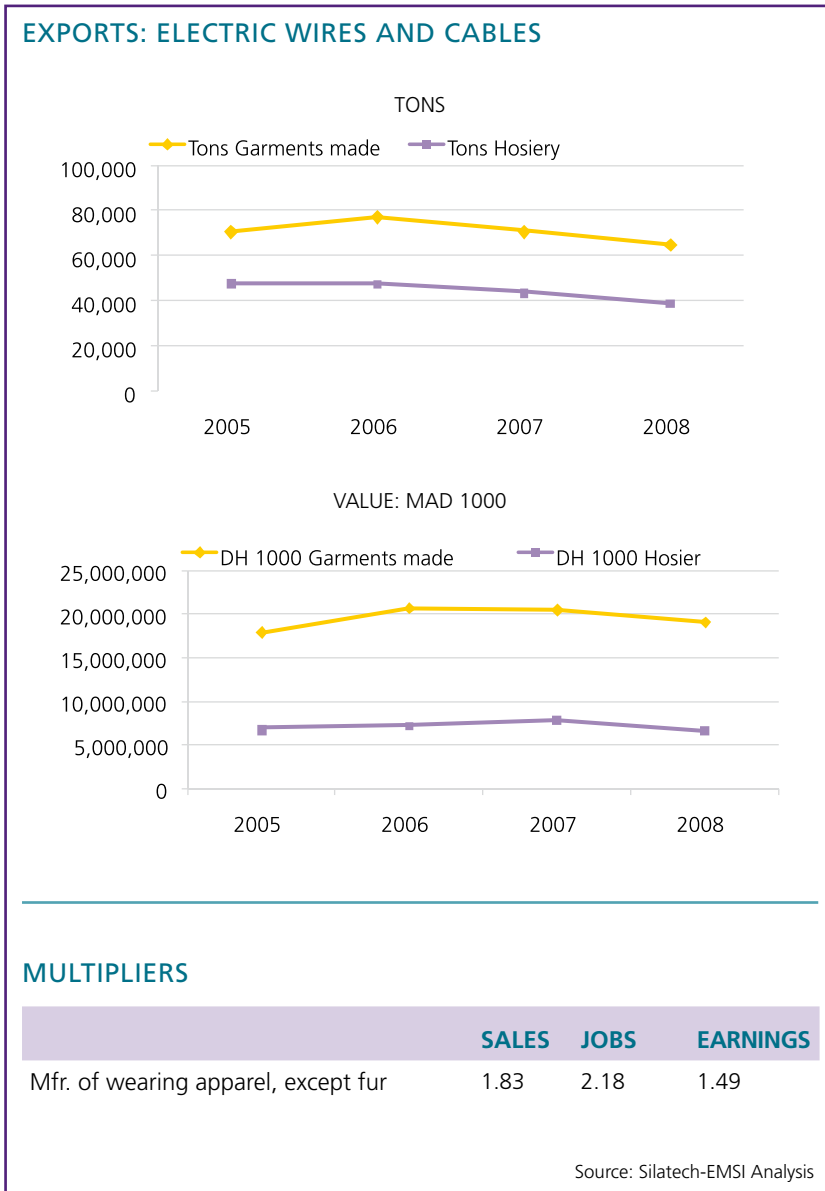
TEXTILES EMPLOYMENT (2007)		
17	Manufacture of textiles	141,476
171	Spinning, weaving and finishing of textiles	v
172	Manufacture of other textiles	19,886
173	Manuf. of knitted and crocheted fabrics and articles	5,384
18	Manufacture of wearing apparel	374,157
181	Manufacture of wearing apparel, except fur apparel	371,028
182	Dressing and dyeing of fur	3,129
19	Tanning and dressing of leather	53,526
191	Tanning and dressing of leather	3,986
192	Manufacture of footwear	49,540
Total		569,159





**ELECTRO-MECHANICAL TRADES DEMAND**

Because global competition is anticipated to affect smaller and less technologically advanced firms more strongly, staffing needs are likely to shift toward more skilled workers. This will create demand for middle-skill workers, such as industrial machinery mechanics and machine programmers, even as employment declines in the industry.



# ELECTRIC AND ELECTRONIC COMPONENT MANUFACTURING

## BACKGROUND

Low-end electric and electronic component manufacturing has become the up-and-coming exporter in the Moroccan economy. In 2007, the electric wire and cable industry surpassed hosiery as the third largest export, signaling its rise in comparison to the textile manufacturers' struggle.

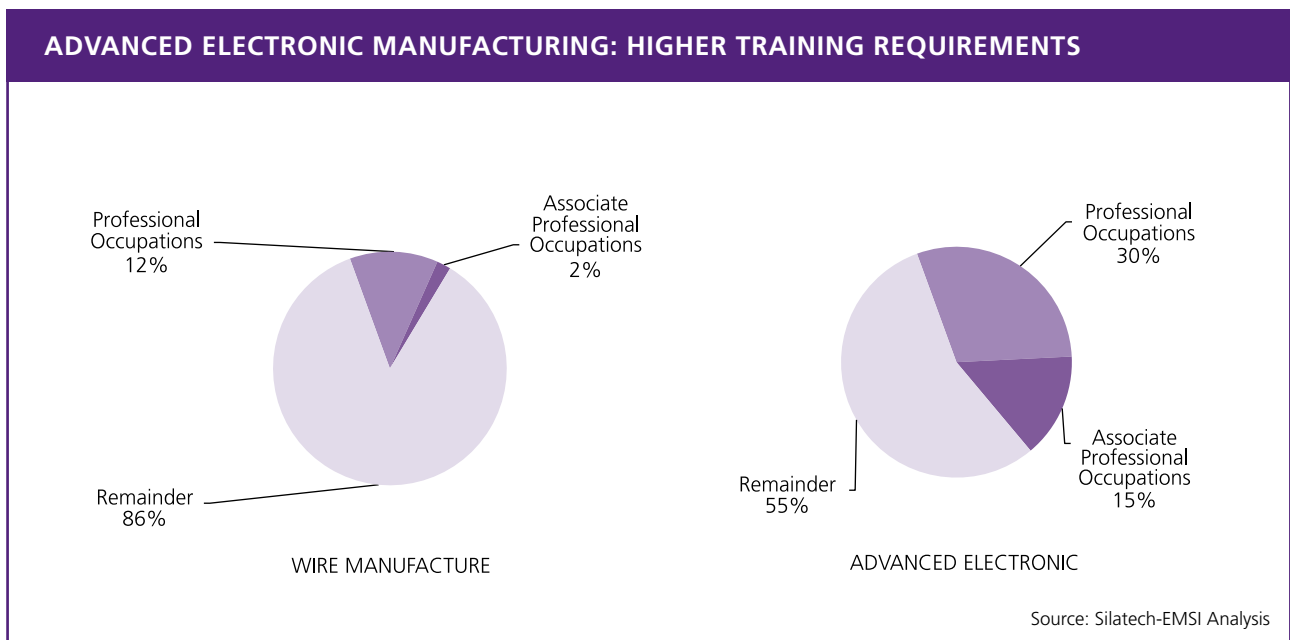
As the low-end component manufacturing base grows, doors open for higher level electric/electronic component manufacturing. As the staffing suggests (see below), growth in higher-level manufacturing would require substantial investment in training, as skilled labor becomes predominant in more advanced manufacturing.

## EXPORTS

Exports of insulated wire and cable rose sharply from 2005-2008. In 2008, 54,000 tons were exported with a value of MAD 8.8 billion. Tonnage has grown by more than 60% since 2005, and the value of the exports has increased over 70%.

## COMPANIES MANUFACTURING BATTERIES AND CABLES

Nexans Morocco has two locations in Morocco, employing 850 people and carrying out turnover of 1.7 billion dirhams in 2008. Its Casablanca site manufactures batteries and prefabricated substations, and its Mohammedia site is dedicated to making electrical cables. Japanese companies Yazaki and Sumitomo (through Automotive Wiring Systems Morocco S.A.R.L.) manufacture wiring in the Tanger Free Zone.



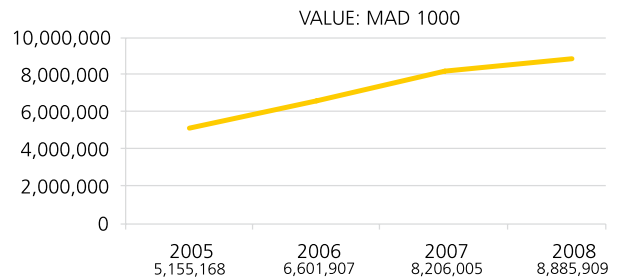
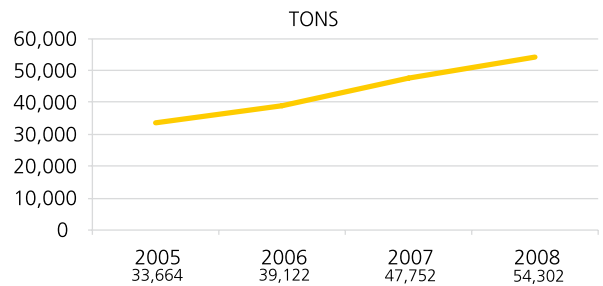
## STAFFING

If Morocco is to extend its reach beyond low-end component manufacturing, more skilled workers are required. Roughly 10% of wiring manufacturing employment falls into the professional category. Advanced electronic manufacturing triples that percentage, as well as adding a significant increase in middle-skilled occupations. Similar to the increasing demands placed on offshoring as demand for ITO increases, movement toward advanced electronic manufacturing places upward demand on skilled workers.

## EMPLOYMENT (2007)

30	Mfr. of office, accounting and computing machinery	1,598
31	Mfr. of electrical machinery and apparatus n.e.c.	39,317
311	Mfr. of electric motors, generators and transformers	11,808
312	Mfr. of electricity distribution and control apparatus	1,147
313	Mfr. of insulated wire and cable	11,672
315	Mfr. of electric lamps and lighting equipment	1,833
319	Mfr. of other electrical equipment n.e.c.	12,857

## EXPORTS



## MULTIPLIERS

	SALES	JOBS	EARNINGS
Mfr. of insulated wire and cable	1.66	1.61	2.27

# ABOUT

## ABOUT SILATECH

Silatech is an innovative initiative engaging the private, public and civil society sectors to promote large-scale job creation, entrepreneurship, and access to capital for young people. It is intended to help address the critical issue of youth unemployment, a serious and growing challenge impacting countries throughout the Arab world. With the support of His Highness the Emir of Qatar and Her Highness Sheikha Mozah bint Nasser Al Missned, Silatech was first announced in 2008 at the UN Alliance of Civilizations Forum in Madrid and launched in June 2008 at the first Doha Summit. More information can be found at [www.silatech.com](http://www.silatech.com).

 **سيلاتك Dilatech™**  
*Young People...Enterprise...Employment...*

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EMSI is an economics consulting firm that provides integrated economic and labor market data, web-based analysis tools, data-driven reports, and custom consulting services. EMSI specializes in detailed information about regional economies for assessment and planning purposes, bringing together industry, workforce, economic development, and education/training perspectives. More information can be found at [www.economicmodeling.com](http://www.economicmodeling.com)

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