Did The Arab Spring Impact The Academic Network Of Tunisia Between 2010 and 2015?

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Contents

1 Introduction 1
  1.1 Objectives .................................................. 1
  1.2 Background .................................................... 2
  1.3 Literature Review ............................................. 3
    1.3.1 Introduction .............................................. 3
    1.3.2 Longitudinal Analysis of Social Networks .............. 3
    1.3.3 Political Events Affecting Academic Networks ........ 4
    1.3.4 Inter- and Intra-national Collaboration Amongst Academics 4

2 Methods 8

3 Analysis 11
  3.1 Tunisian-Only Networks ...................................... 11
  3.2 Activity ........................................................ 13
  3.3 Cohesiveness ..................................................... 16

4 Discussion 18

5 Conclusion 23

6 Lessons Learned 24

Appendix 25

Bibliography 34
List of Figures

3.1 Average degree by month ........................................ 12
3.2 Total collaborations ............................................ 14
3.3 Most active countries .......................................... 15
3.4 Most active cities .............................................. 15
3.5 Clustering coefficient .......................................... 16
3.6 Network sizes .................................................. 17

4.1 Coauthorship network visualizations ......................... 19
4.2 Collaboration of cities network visualizations .............. 20
4.3 Collaboration of countries network visualizations .......... 21
# List of Tables

1.1 Official International Collaborations . . . . . . . . . . . . . . . . . . 4

6.1 Timeline of political and academic event in Tunisia, 2006 to 2014 . 25
Chapter 1

Introduction

The news media can give the impression that human history and politics is one series of traumas after another. From major events such as Occupy Wall Street [1], the protests and subsequent coup in Thailand [2], and wars like the civil wars in Ukraine [3], political events impacting the lives of millions seem to be never-ending. It therefore becomes relevant to evaluate the true disruptiveness of events such as these. The effect of large-scale political events on coauthorship networks provide compelling case studies for evaluating the effect political events have on society, since research, development, and the flow of ideas can be an efficient indicator of a country’s stability. These interests led to the formation of the research question: Did the Arab Spring affect the academic network of Tunisia?

1.1 Objectives

Through an exploratory approach, this paper intends to answer the research question by addressing the following research objectives:

1. Understand trends in intranational collaboration within Tunisia

2. Understanding trends in international collaboration that involve Tunisian academics

Our longitudinal analysis attempts to find any statistically significant changes in the network structure that corresponds to international and intranational collaborations with Tunisian universities. Temporal dynamics in network analysis are critical in this investigation because they allow us to see the formations, changes, and patterns of association within the network of relations over time.
1.2 Background

In 1897, Zine El Abidine Ben Ali came to power in a coup d’etat as President Habib Bourguiba’s health began to decline [4]. What began as a regime which reversed some of Bourguiba’s repressive tactics soon began to adopt a hardline approach. Ben Ali’s rule was marred by high unemployment rates, poverty and poor living conditions, inflation, corruption, censorship, and government repression [4]. Since the turn of the millennium, economic statistics generally reflect a positive increase. For instance, the GDP per-capita increased from $7182 in 2005 to $9489 in 2010 [5], and between the 2009-2010 and 2010-2011 reports, Tunisia gained eight points in the World Economic Forum’s Global Competitiveness Index. [6] However, according to survey research conducted by Gallup, Tunisian contentment with basic infrastructure, the cost of living, basic services, and evaluation of personal wealth reflects widespread discontent between 2005 and 2010. [5]

On December 17, 2010, an unemployed street vendor self-immolated after the police confiscated his produce due to his lack of necessary permits. [7] With help from social media, protests quickly spread throughout the country. On January 14, 2011, Ben Ali resigned and fled to Saudi Arabia. [8] After a period of governmental instability, the Islamist Ennahda Party won a democratic election on October 23rd. During Ben Ali’s rule, a close international alliance with the US, Europe, and other Mediterranean and North African countries was adopted. Following the rise of the Islamist Ennahdas, collaboration with the US decreased in favour of closer collaboration with the Middle East, but collaboration with Mediterranean, North African, and European countries continued, due largely to their proximity. [9]

The Arab Spring not only influenced Tunisia’s social and political history, but also affected its academic history. The Arab Spring drove new academic partnerships within disciplinary areas that carried less weight than before the protests [10]. For example, there have been new opportunities for fieldwork and academic discussion around formerly taboo topics such as economic reforms and tolerance for democracy (United Nations, 2015). In order to support these collaborations and their academic freedom, recent changes have been made to the Tunisian Constitution [10]. Specifically, the constitution currently states, “Academic freedoms and freedom of scientific research shall be guaranteed” [10]. This effort is in the hopes of supporting the advancement of democratic habits within academia, which will then hopefully spread into everyday society [10]. Additionally, the “Methodology for the Reform of the Education System” was held on March 2012. It attempted to create agreement on an educational reform and concluded with preferred methodologies and future goals [11]. One of the future goals included a “wide national participation in the educational reform” [11]. The initiatives for change and cooperation can be anticipated to impact Tunisia’s academic landscape. To understand the specific impact requires an analysis.
1.3 Literature Review

1.3.1 Introduction

In order to address the research question, a literature review was done in three areas: (1) efforts in longitudinal analysis of social networks, (2) political events affecting academic networks, and (3) international and intranational collaboration amongst academics. This consisted of an search of articles from a variety of sources. One source included peer reviewed journal articles obtained from the University of Waterloo’s search database, Primo. Other sources included university websites, funding websites, news articles, and collaborative blogs. These were relevant because they captured history and current conversation related to international and international collaborations amongst academics. Major search terms included longitudinal, temporal, social networks, political, war, revolution, collaboration and cooperation. The literature review is described and ordered by its three areas as follows.

1.3.2 Longitudinal Analysis of Social Networks

Part one of the literature review assessed efforts in the longitudinal analysis of social networks. The study of longitudinal analysis of social networks is not a new technique in research, having adequate frameworks developed for their analysis since the 1950’s [12]. However, very few studies have employed sophisticated statistical models within this type of analysis [12]. This is because applying such models can be difficult [12].

Runger et al. [13] attempted to employ statistical models to longitudinally measure the relations within friendship networks. As an extension off of Hallinan’s 1978 longitudinal analysis of friendship models [13]. developed and tested several statistical models with structural parameters that can be used to properly estimate confirmatory partners within the model over time [13]. They highlighted the difficulties encountered when employing such models. Three conclusions were made: (1) in order to increase the likelihood for the researcher to detect significant relations within the model, there needs to be a continuous record of the phenomenon being studied, (2) population heterogeneity makes it more difficult to implement statistical analysis, and (3) measurement error can be sensitive to the number of choices made by each actor within the model [13]. Therefore the whole picture is not yet complete, various improvements are still needed to employ statistical models in order to analyze longitudinal relations within a network model.
1.3.3 Political Events Affecting Academic Networks

Part two of the literature review revealed that an analysis of the collaboration networks of academics during political turmoil has not yet been done before. Let alone over time.

1.3.4 Inter- and Intra-national Collaboration Amongst Academics

In terms of international collaborations, a summary of these collaboration programs are displayed in table 1.1.

<table>
<thead>
<tr>
<th>International Collaborators</th>
<th>Program</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunisia-France [14]</td>
<td>Tunisian-French joint committee for University Cooperation (JCUC)</td>
<td>Instituted with the Projects and Programs Committee (PPC), and serves to advance cultural, scientific and technological cooperation between the two countries.</td>
</tr>
<tr>
<td></td>
<td>Cooperation Agreement (GDSTR/NCSR)</td>
<td>Joint research programs have been carried out since 1976. Sets up academic exchanges (3 years), and federates French/Tunisian teams working on intra- and inter-disciplinary projects.</td>
</tr>
<tr>
<td></td>
<td>Cooperation Agreement (GDSTR / NIHMR)</td>
<td>Cooperation agreement with the National Institute for Health and Medical Research in France, allowing exchange of teachers and researchers for a two year period.</td>
</tr>
<tr>
<td></td>
<td>Cooperation Agreement (Tunisian Universities - INRIA)</td>
<td>Cooperation between DGRSRT (representing several Tunisian universities) and the National Institute of Research in Computer Science and Automatic (INRIA) in France. Conducts annual proposals to collect joint research projects in computer science, automatic and applied mathematics.</td>
</tr>
<tr>
<td>International Collaborators</td>
<td>Program</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Tunisia-Morocco</td>
<td>Tunisian-Moroccan Permanent Joint Committee (TMPJC) for Scientific and Technological Research</td>
<td>Promotes partnership in the field of scientific and technological research between the two countries.</td>
</tr>
<tr>
<td>Tunisia-America</td>
<td>The Council of American Overseas Research Centers (CAORC) [15]</td>
<td>A federation of independent overseas research centers that promote research in the humanities and social sciences, emphasizing on cultural heritage and modern societies. Promotes international research exchanges through sponsorship, foreign language study, collaborative research projects, etc. The members of CAORC have centers in Afghanistan, Algeria, Bangladesh, Bulgaria, Cambodia, Cyprus, Egypt, Greece, India, Indonesia, Iran, Israel, Italy, Iraq, Jordan, Mexico, Mongolia, Morocco, Pakistan, Palestine, Sri Lanka, Tunisia, Turkey, West Africa, and Yemen.</td>
</tr>
<tr>
<td></td>
<td>US-Tunisia Embassy [16]</td>
<td>Funding opportunities are offered by the U.S. Government to support Tunisian institutions and individual researchers.</td>
</tr>
<tr>
<td>Tunisia-EU</td>
<td>ETC (European-Tunisian Cooperation) and FETRIC (Future European-Tunisian Research Innovation Cooperation) [17]</td>
<td>Serves to advance academic collaboration between the EU and Tunisia.</td>
</tr>
</tbody>
</table>
Additionally, not only has international collaborations sprung up between Tunisian and foreign universities, but international collaborations have gained momentum for Tunisia’s neighbouring countries as well [10]. For example, “Access to Justice and Institutional Development in Libya” is a cooperative project formed between the University of Benghazi in Libya, and Leiden University in the Netherlands’ [10].

In terms of intranational collaborations between Tunisian universities in varying cities, these have been made possible through the efforts of a variety of national conferences [18]. These conferences span a variety of disciplines from nanotechnology engineering to English language studies [18]. These conferences also host the knowledge transfer from academia out into society. For example, the The Tunisian Society for Financial Studies (TSFS), established in 2013, is an academic organization that promotes the transfer of knowledge between academics and practitioners in finance [19].

University collaborations and worldwide funding opportunities aimed towards contributing to Tunisia’s higher education system are of relevance to our research. With evidence of such partnerships existing both before and after the Arab Spring,
it can be anticipated that changes and increases in collaborations could be detected in our network analysis.
Chapter 2

Methods

The data was obtained from ISI (WOS), an online database of academic meta-data [20]. Metadata regarding all works published between 2006 and 2015 with Tunisian authors were downloaded in ISI’s proprietary database format. This range was chosen because it has the Arab Spring centered, allowing for an equal time span on either side. Most of these records represented articles or conference proceedings, with some books, or other record types. Inspection and experimentation of the format allowed us to write scripts, see [21] for the source that extracted authors, their locations and the date of publication. These are provided by the ‘AF’, ‘C1’ and ‘PY’/‘PD’ field tags respectively. These then allowed us to create the necessary networks.

The weighted co-authorship networks were made on a per month basis. These are undirected networks with authors as nodes and edges representing shared publications. The authors in each network are both Tunisian and non-Tunisian; we consider them Tunisian if their address as provided by ISI is within Tunisia, by design every author at was at least a collaborator with Tunisians that month. The weight assigned to each edge between authors was a whole number counting the number of times those authors co-occurred (i.e. every time two authors published together in the month their weight incremented by one). We could have used an unweighted network, effectively dichotomizing the network, but we felt that the extra precision was more important. This choice of weight was meant to approximate the amount of collaboration each author was engaged in; it misses the informal collaborations and the collaborations which have not been published, and over counts collaborations which produce multiple papers from a single project. These issues are well characterized and understood by others undertaking this type of research [22].

Keeping the co-authorship network as a baseline, we filtered and contracted them, see [23] for the source. To investigate international collaboration, we looked at the co-country network. To investigate intranational collaboration, we looked at
the co-city network, filtering out to cities outside of Tunisia and contracting those inside. The weight of the edges between the resultant nodes are then the sum of the individual weights of the contracted nodes’ constituent nodes’ edges, which means that between two cities or two countries there are many collaborations counted per month. By design of our collection method the co-country network counts collaborations between each country which is also a collaborator with Tunisia (i.e., it is the ego-network of Tunisia). This was formed by the same type of contraction that created the co-city network. These three networks could then be filtered one more way, specifically by removing those contributions to the network caused by non-Tunisian papers, we define Tunisian papers to be those possessing a Tunisian reprint address (i.e. papers not attributed to Tunisia). Thus, we created the co-author, co-city and co-country collaboration networks of Tunisia and could either examine those due to every paper or those due to only Tunisian papers. Of note, we attempted to look at the co-institution network of Tunisia’s universities and other publishers, but were unable to due to problems with the ISI’s data.

This type of network generation is not without its limitations. First, the data provided by ISI had numerous issues that may have skewed our results. The largest of these is the established bias towards English language and particularly American publications, for which we have no control over in our statistics. Secondarily is the inconsistency of the format, as many records were missing key information such as but not limited to the egregiously terrible handling of location information and the inconsistent abbreviation or simply misspelled labels for institutions and cities. Lastly, we discarded approximately a quarter of the records, because their dates only included a year, or were not parable based on our empirically derived parsing engine. Dates giving as a season were put to the first month of said season (i.e. Winter was mapped to December). These limitations led us to some decisions about our analysis techniques.

Once the networks were formed, analysis could be performed. Our main goal was studying the activity and cohesiveness in these networks. As a proxy for the amount of activity, we counted the total number of collaborations each node was involved in by taking its degree, in a weighted network. This is the sum of the weight of all edges to the node [12]. To get a single global number for each network at each time point, we averaged it by the number of nodes in the network. We assumed for simplicity that more activity means more papers published. Similarly, to measure the cohesiveness of each network, we computed and averaged the clustering coefficient over each node. The clustering coefficient is the ratio of the number of triangles involving the node to the maximum number possible; it is a local measure that correlates with the cliquishness of the node [12]. As a mean it measures how insensitive the network is to the removal of a single node (i.e. cohesiveness). To mitigate the unavoidable bias from having an ego-network [12],
we decided to remove Tunisia before computing these on the co-country network. When unremoved, Tunisia skewed all means causing the mean to be sensitive to changes in absolute number of nodes. With these per network numerics, we were able to proceed with our analysis.

Since we chose to look at the academic community longitudinally, these metrics form a time series. We would like to be able to compare the before and after the Arab Spring to argue the possible presence of an effect or not. Unfortunately, we cannot do this with the formal statistical tools, $\chi^2$, Student’s $t$, etc., because each data point is measuring the same set of actors as the previous, meaning the samples are non-independent. For the scope of this study, therefore, we restricted ourselves to plotting and appraising the metrics qualitatively.
Chapter 3

Analysis

We first assessed the impact of removing non-Tunisian papers from all the networks. Following this we analyzed two main areas: (1) Activity and (2) Cohesiveness. Of the many networks, none of the statistics generated had statistically significant changes succeeding the Arab Spring. However, there are still some changes worth noting although not statistically significant, which are mentioned throughout the three sections.

3.1 Tunisian-Only Networks

The filtering of non-Tunisian papers from the network appears to have had little effect on the overall present trends. It instead removes some of the variance from the metrics. For those metrics sensitive to total number of nodes, it had the expected effect for our measures, which was a blanket decrease. A representative example of this can be found by comparing the average degree by month of both Tunisian papers only figure 3.1(a) and Tunisian networks figure 3.1(b).

The two effects, smoothing and dropping can be comprehended by by understanding what is removed in the filter. The former effect is due to the removal of large scale international publications, which are usually not based in Tunisia and have many authors causing a major increase in edge weight and triangle count. From our data set, the largest example of this is a paper from 2012 [24] with over 200 authors. The latter effect is simply a result of the removal of some nodes. In terms of average degree, the removal of the average node will have no effect on the measure as they are an average, and therefore do not have an effect. However, the removal of one from the long tail of high degree nodes will, which explains the slight drop in average degree. The non-Tunisian papers tend to have higher degree authors as they include many large groups more often.

The other measures showed similar correlations between filters and unfiltered.
(a) Average degree by month of networks using only Tunisian papers

(b) Average degree by month of networks using papers with a Tunisian author

Figure 3.1: Average degree by month of each type of network, log-linear scaling. Yellow line is the start of the Arab Spring in Tunisia
Therefore the rest of our analysis will only look at the full networks so as not to avoid repetition.

3.2 Activity

The co-country and co-city networks reflect different facets of the coauthorship network, which unites the story of Tunisia’s intranational and international collaboration. This becomes evident through analysis of the activity plots.

Figure 3.1(b) shows our measurements of collaboration vs time. It is worth noting that this gives the average per node, whether the node is an author, city, or country, the individual author level of collaborations between the average nodes in that window of time. Therefore, we can consider this to be a measure of the rate of overall collaboration in the network with respect to time. Average degree does tend to increase over time, which could be due to an actual increase in activity within the network or possibly improvements in ISI’s coverage of Tunisia.

By inspection, it can be seen that for Tunisia, changes in author collaborations are usually correlated with a change in international collaboration. This can be seen (as noted above) by the significant increases of a single month in 2006, 2010 and 2012; that last of which is almost entirely due to a single study [24], which had some Tunisian authors. The collaboration between cities though was not at all affected since only one or two were involved and only in minor ways.

Since the metric was an average, the absolute size of a network has a major influence on it. The cities and countries networks, as contractions of the authors network, necessarily are always smaller and so have higher averages. The difference between cities and countries requires more investigation but is likely due to the confluence of two factors: (1) there being more cities than countries in the network, the number changes by month, but in all of 2014 we encountered 131 countries and 190 cities (this is less noticeable by month, see figure 3.6), and (2) the removal of many edges in creating of the city network, all non-intranational collaborations were removed.

Even qualitative inspection yields no change in the activity of any of the networks after the Arab Spring. The only major event is the great increase in 2007, which is likely due to the changes in ISI’s database that became visible to users in 2008 [22] and the ongoing efforts of the government to foster academic growth. Since no major political, economic, or academic events occurred in 2007, it is likely that these factors were not the cause of this trend.

Figure 3.2 shows the number of collaborations between Tunisia and other countries (Blue) against the number between Tunisian authors (Black). Both international and intranational collaboration were increasing before the Arab Spring, however, international collaboration appears to continue at the same rate while
Tunisia’s Collaborations

Figure 3.2: Total collaborations between Tunisia and other countries (Blue), and between cities within Tunisia (Black), by month, log-linear scaling. Yellow line is the start of the Arab Spring in Tunisia

Intranational slows. Additionally, this shows more international collaboration exists than intranational (note the plot is on a log scale, the difference is between a factor of 1.5 and 5).

To further examine the differences in international and intranational collaboration we looked at individual elements of each network. For international collaborations, we examined the top collaborators with Tunisia, figure 3.3 and for intranational collaborations, top cities by degree was analysed figure 3.4. For both figures, we see the same pattern in that collaboration is increasing before and after the Arab Spring. This trend holds regardless of the chosen city or country. Of the countries, France stands out as the largest collaborator by an order of magnitude. This is due the colonial history of Tunisia, lack of language barriers, and government programmes, all of which contributed to the establishment of many long-standing collaborations. Within the cities, while there is stratification, it is much less pronounced. Tunis, the capital, is generally first, with the three other major coastal cities of Monastir, Sfax and Sousse close behind. Hammam Lif, the fifth, is a smaller city 20 km away from Tunis that does its majority of collaborating with its large neighbour tunis. Since this is a measure of collaboration, we can say that the data does not show a splitting of Tunisia’s academic network after the Arab Spring, figure 4.2 shows the network before and after.
Figure 3.3: Most active collaborators with Tunisia. Yellow line is the start of the Arab Spring in Tunisia

Figure 3.4: Most active cities within Tunisia. Yellow line is the start of the Arab Spring in Tunisia
Figure 3.5: Clustering coefficient, by month, log-linear scaling. Yellow line is the start of the Arab Spring in Tunisia

### 3.3 Cohesiveness

Figure 3.5 shows the average clustering coefficient for each of the networks. This is a proxy for sensitivity to the removal of nodes, and can therefore be considered to measure cohesiveness [12]. Similarly to the activity, no noticeable changes in trends can be determined after the Arab Spring.

The size of the network, while less directly related to cohesiveness, does tell us about its structure. Figure 3.6 shows the size of the networks over time, both for context and to give a reference for the reliability of the averages. The coercing of seasons into months as discussed in the methods results in the period spikes every three months as a result of this influx. In line with the rate of collaboration increasing, the number of publishing authors increases with time. This also shows that the number of publishing countries and Tunisian cities increases with time, which seems a bit suspicious. Logically, publishing with Tunisia should be roughly constant within a very short time period. This might be the evidence the trend should be attributed to a growth in ISI’s coverage.
Figure 3.6: Network sizes, by month, log-linear scaling. Yellow line is the start of the Arab Spring in Tunisia
Chapter 4

Discussion

The use of a time series to study the impact of the Arab Spring on Tunisia was not as successful as hoped. Therefore we are not able to report any statistically significant effects of the Arab Spring on Tunisia’s academic networks.

Since longitudinal analysis of social networks has rarely been attempted before, we had hope that our methodology would prove viable. However, our method of generating per month analytically derived metrics did not allow us to make a quantitative analysis. This methodology could have been improved through a more detailed analysis of network time series or modified by looking at a different measurement visualizations. A detailed analysis of network time series can be seen in [13]. This requires much more computational power and modelling that we did not have access to. The visualizations are another qualitative method for examining time varying networks. By looking at figures 4.1, 4.2 and 4.3, which show two years (2006 and 2014) for each of the networks there are visible differences such as the density of points and lines in each is much greater in 2014 than 2006. These visible differences are a reflection of the increase in average degree and size of the networks over time seen in our monthly plots. This method was not employed by us as it leaves the user much more susceptible to being lead astray then our chosen approach. Visualizations of this kind of network often appear as “hairball networks” [22] from which no useful information can be gleaned, also to obtain meaningful information the algorithm employed must be understood, i.e. how energy minimization algorithms display changes in edge count. Future work involving visualizations could still be done if these and other issues were accounted for.

There is theoretical significance of the analysis. It has contributed to the existing literature by attempting to employing simple statistical models in order to support a longitudinal analysis of social networks. This makes an addition to lack of effort within this area as addressed by Wasserman et al. [12]. Additionally, this project has contributed to the literature by making efforts towards assessing
Figure 4.1: Coauthorship network visualizations of papers with Tunisian authors in 2006 and 2014.
Figure 4.2: Collaboration of cities in Tunisia network visualizations in 2006 and 2014
Figure 4.3: Collaboration of countries with Tunisia network visualization in 2006 and 2014

(a) Collaboration of countries in 2006

(b) Collaboration of countries in 2014
if a period of political turmoil affected academic networks. This is of relevance to Tunisia in particular because it makes efforts towards detecting if the rise in academic collaborations have actually affected its social networks or not.

Although the literature review highlighted the formation of a variety of new collaborations within higher education, which suggested the possibility for potential trends within our analysis of our networks, there were no statistically significant changes detected. We suggest four potential reasons as to why significant changes were not detected. First, some of the international collaborations have only recently been established after the Arab Spring. Therefore they have not had enough time to develop and sustain a noticeable impact within intranational or international collaboration networks. Second, it can be difficult to achieve success within that type of partnership [25]. Even if agreements are signed, it can be difficult to achieve success, particularly between African universities and universities from developed countries [25]. Difficulty in success can be due to unanticipated challenges in the collaboration, which result in fewer outcomes than desired [25]. Third, it has been well documented that American universities are attracted towards collaborations with African universities [26]. However, the lengths of these collaborations are often short-lived, and only of small offerings [26]. This suggests that it may be difficult to sustain long-term collaborations that create noticeable impacts within the academic communities. Fourth, many Tunisian Universities are still very young. The majority of the leading universities were founded between the year 2000 and 2005. Such recent establishments make them less likely to have created collaborations with other institutions unlike older universities [10]. This affects many of the measurements we are making of the networks, such as the cohesiveness.
Chapter 5

Conclusion

If the reader was to step into the shoes of a Tunisian researcher, a change in how a government leader is elected should not immediately affect who one chooses to collaborate with immediately. Intranationally, an event such as the Arab Spring should not have a huge effect on who a research would choose to collaborate with, for this does not open any new networking opportunities which were not previously present. Additionally researchers would continue to collaborate with those with whom they are already familiar. Internationally, although the Arab Spring did change Tunisia’s foreign policies, it does takes time for acquaintances to be formed, trust to be established or mindsets to reconcile. All this is rendered more complicated with the language barrier between countries. The only thing that now appears counter-intuitive is why increased academic freedom and anticipations in an increase in partnerships did not promote greater collaboration. Therefore we recommend further investigation of this topic and continuous improvements to longitudinal analysis of social networks.
Chapter 6

Lessons Learned

At the beginning of the group process it was clear that our skills and strengths were divided between qualitative and quantitative skill sets. At first, this was viewed as an advantage, seeing that our group had ‘‘the best of both worlds’’. However in this attempt mistakes were being made and it was soon realized that in order to create a meaningful outcome from our collaborations, we had to focus our attention on figuring out how both of these skill sets could be integrated. Upon realizing the difficulties at this attempt, our group set aside time from our regular work to understand each others communication styles and brainstorm how we could interface and collaborate more effectively. For example, members agreed to be more conscious about communicating their assumptions. This was important because conversation directions were directed by assumptions and if these were not communicated effectively, than two members might think a conversation is heading in different directions. This made it difficult to reach agreements on conclusions.

The effort to create shared understandings amongst members was what directed which skills we chose to build. For example, Amy was having difficulties understanding how Reid and Nick were extracting the Web of Science data and applying network analysis tools. Therefore she attempted to learn basics in Python in order to improve her understanding. This allowed for easier communication styles and interpretation of the data as a group. In general, each member chose an area outside of their disciplinary expertise to improve upon, thus assisting efforts in shared understandings.

Overall if we were to do the process again, we would make three improvements. First would be to create a group contract about communication styles, deadlines and anticipations for future commitments. Second would be to choose only one or two forms of channels of communication. Third would be to start the process of learning technical skills earlier.
# Appendix

Table 6.1: Timeline of political and academic event in Tunisia, 2006 to 2014

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Political Event</th>
<th>Academic Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>October</td>
<td>As a result of commentaries in opposition to the Tunisian government, broadcasted by al-Jazeera, Tunisia decides to close its embassy in Qatar where al-Jazeera is based. [27]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>December</td>
<td>A woman is elected as the leader of a party for the first time in Tunisia. [27]</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>January</td>
<td>Twelve people are killed as Islamist militants and security forces clash in Tunis. [27] The Tunisian government launches the ambitious 2007-2011 Country Strategy paper, which cites the economic success of the 2002-2007 Five-Year Plan, yet alludes to the high unemployment rate and water scarcity. [28]</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td>A global economic recession hits, and Tunisia experiences reduced exports to Europe. [4]</td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Month</td>
<td>Political Event</td>
<td>Academic Event</td>
</tr>
<tr>
<td>------</td>
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<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td></td>
<td></td>
<td>Drought hits Tunisia, causing the agricultural sector (in which one-quarter of the population is employed) to dip significantly. [4]</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>July</td>
<td>The Tunisia economy reaches its lowest growth level of 3.1 percent in a decade. [28]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nine men are charged with intending to kill US servicemen during a joint military exercise. [27]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>October</td>
<td>President Ben Ali wins a fifth term in office. [27]</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>December</td>
<td>Protests break out over rising unemployment rates, poverty levels, inflation, and government repression. The movement quickly spreads nationwide, with social media playing a large role. [27]</td>
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</tr>
<tr>
<td></td>
<td>January</td>
<td>Following three weeks of violent protests, President Zine El-Abedine Ben Ali goes into exile and takes refuge in Saudi Arabia. In his absence, Mohamed Ghannouchi is sworn in as Prime Minister. Events in Tunisia inspire the Arab Spring, a period of similar political revolts throughout the Arab world. [27]</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>February</td>
<td>Ghannouchi resigns. In response to demands by demonstrators, he advocating a clean break with the past. [27]</td>
<td></td>
</tr>
</tbody>
</table>
Table 6.1: Timeline of political and academic event in Tunisia from 2006 to 2014

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Political Event</th>
<th>Academic Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>March</td>
<td>A date for democratic elections is set. By court order, the party of former President Ben Ali is dissolved. [27]</td>
<td>The ATDocS (The Tunisian Association of Doctors &amp; PhD Students in Science) is established by PhD graduates and students working to promote scientific research in Tunisia, with the intention of helping scientists in Tunisia network with each other and with researchers abroad. [29]</td>
</tr>
<tr>
<td>April</td>
<td>April</td>
<td>During clashes with rebels, troops from Libya crosses Tunisian borders. [27]</td>
<td></td>
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<tr>
<td>May</td>
<td>May</td>
<td>As a result of fresh street protests, curfew are imposed. [27]</td>
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<tr>
<td>June</td>
<td>June</td>
<td>Ben Ali is sentenced to 35 years in prison, having been tried absentia for theft. [27]</td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>October</td>
<td>The Ennahda Islamist party wins parliamentary elections, but with a minority government. [27]</td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>November</td>
<td>The National assembly meets for the first time, with the drafting of a new constitution in task. [27]</td>
<td>The ATDocS (Tunisian Association of Doctors &amp; PhD Students in Science) holds its first meeting. [29]</td>
</tr>
<tr>
<td>December</td>
<td>December</td>
<td>Moncef Marzouki, a known human rights activist, is elected President by the constituent assembly. Hamadi Jebali, leader of the Ennahda Islamist party, is sworn in as Prime Minister. [27]</td>
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<td>2012</td>
<td></td>
<td></td>
<td>“Allergic Rhinitis and its Impact on Asthma (ARIA): Achievements in 10 years and future needs”, with 217 authors (including Tunisian researches) is published. [24]</td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td></td>
<td>The United States Institute of Peace and Georgetown University’s Democracy and Governance Program launches discussions regarding educating a generation of Tunisian specialists in democratic studies, development, and conflict resolution. [30]</td>
</tr>
<tr>
<td>2012</td>
<td>May</td>
<td>Islamic extremists clash with security forces. [27]</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>June</td>
<td>Saudi Arabian government refuses to extradite Ben Ali, who is sentenced to death for the killing of protesters during the Arab Spring. [27]</td>
<td>One man dies of a gunshot wound following Islamist riots. An overnight curfew is imposed by the government. [27]</td>
</tr>
<tr>
<td>2012</td>
<td>August</td>
<td>Following reductions in women’s rights by the new government, thousands protest in Tunis. The new constitution describes women as “complementary to men” &amp; in contrast with the term full equality between men and women in the 1956 constitution. [27]</td>
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<td></td>
<td>February</td>
<td>The death of anti-Islamist leader, Chokri Belaid, prompt violent protests. Islamist Ennahda Party rejects allegations that it was behind the killing. Prime Minister Jebali, leader of the Ennahda Party, proposes to form a government of technocrats, but is rejected by his party. Jebali resigns. [27]</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>February</td>
<td>The final conference for the European-Tunisian Cooperation (ETC) takes place, during which science and technological research is discussed. [17]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>March</td>
<td>Clashes take place between police and Salafi Islamists of the Ansar al-Sharia group. [27]</td>
<td>A conference focusing on the new opportunities and threats faced by universities in countries affected by the Arab Spring is held in Tunisia. [31]</td>
</tr>
<tr>
<td></td>
<td>March</td>
<td>Seminars hosted by the United States Institute of Peace and Georgetown University’s Democracy and Governance Program to promote democratic studies in Tunisia begin. Participants include scholars and policy analysts from Tunisian universities and faculties, such as the Faculty of Law and Political Science at Tunis University. An outline of intended activities to be pursued with American colleagues is presented by Tunisian participants at the conclusion of the conference. [30]</td>
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<td>April</td>
<td>The International Conference on Sustainable Water Management takes place in Tunis, allowing Mediterranean-region scholars to discuss new findings in the water management, treatment and reuse/recycling for sustainable water management. Some successful EU projects were also presented. [17]</td>
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<tr>
<td></td>
<td>July</td>
<td>Demonstrations and strikes against the government takes place after the assassination of opposition politician Mohamed Brahmi [27]</td>
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<tr>
<td></td>
<td>September</td>
<td>The European-Tunisian Cooperation replacement, FETRIC, is launched. FETRIC serves to increase dialogue and collaboration in research between EU and Tunisia by: setting up a link between relevant actors in the STEM community, improving partnerships between researchers and entrepreneurs, developing a research and innovation network in the North African region, and encouraging the participation of Tunisian research centres in the forthcoming program Horizon 2020. [17]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>October</td>
<td>The governing Islamist Ennahda Party consents to handing power over to a caretaker government of non-party affiliated, independent figures, who is to organize new elections. [27]</td>
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<td>2014</td>
<td>January</td>
<td>The first constitution since the 2011 Revolution is passed by Parliament. [27]</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>December</td>
<td>Ennahda and the mainly secular opposition appoints Mehdi Jomaa as head of interim government. [27]</td>
<td>The International Chemical Engineering Congress (ICEC 2013) is held at Djerba, Tunisia. Organised by the Tunisian Chemical Engineering Society, the meeting serves to promote exchange of ideas in Chemical Engineering.</td>
</tr>
</tbody>
</table>
Bibliography


[10] The 'Arab Spring' sent ripples across Middle East academia | EAB Daily Briefing.


[16] Bilateral relations.
[17] Eu-tunisia scientific and technological cooperation agreement.


[30] Tunisia. DEMOCRACY, DEVELOPMENT AND CONFLICT RESOLUTION STUDIES IN THE NEW TUNISIA.