

1 Predication of languages development and 2 recommendations of new international offices 3 locations

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5 **Abstract:** A single paragraph of about 200 words maximum. For research articles,
6 abstracts should give a pertinent overview of the work. We strongly encourage authors to
7 use the following style of structured abstracts, but without headings: 1) Background: Place
8 the question addressed in a broad context and highlight the purpose of the study; 2)
9 Methods: Describe briefly the main methods or treatments applied; 3) Results: Summarize
10 the article's main findings; and 4) Conclusions: Indicate the main conclusions or
11 interpretations. The abstract should be an objective representation of the article; it must not
12 contain results which are not presented and substantiated in the main text and should not
13 exaggerate the main conclusions.

14 **Keywords:** prediction; languages; development; trend; modelling; mathematics

15 **1 Introduction**

16 There are currently about 6,900 languages spoken on Earth. About half the world's
17 population claim one of the following ten languages (in order of most speakers) as a native
18 language: Mandarin (incl. Standard Chinese), Spanish, English, Hindi, Arabic, Bengali,
19 Portuguese, Russian, Punjabi, and Japanese. However, much of the world's population also
20 speak a second language. When considering the total numbers of speakers of a particular
21 language (native speakers plus second or third, etc. language speakers), the languages and
22 their order change from the native language list provided. The total number of speakers of
23 a language may increase or decrease over time because of a variety of influences to include,
24 but not limited to, the language(s) used and/or promoted by the government in a country,
25 the language(s) used in schools, social pressures, migration and assimilation of cultural
26 groups, and immigration and emigration with countries that speak other languages.
27 Moreover, in our globalised, interconnected world there are additional factors that allow
28 languages that are geographically distant to interact. These factors include international

29 business relations, increased global tourism, the use of electronic communication and
 30 social media, and the use of technology to assist in quick and easy language translation.
 31 Thus we aim to combine those factors, setting up a model that able to calculate the
 32 distribution of various language speakers over time. Then we can use the model to predict
 33 what will happen to the number of native speakers and total language speakers in the next
 34 50 years, followed by considering whether the geographic distribution of these languages
 35 changes over this period by reference the global population and human migration patterns.
 36 Finally, we will suggest that where to set up an international office to a multinational
 37 company.

38 **2 Summary**

39 We have developed a model to address the distribution of the language speakers
 40 worldwide over time. Several assumptions about the purposes people learning a second
 41 language and the conditions of the native speakers are made by us to get the following
 42 formulae:

$$N = Ri_{non-native} \times \frac{a}{b \times d} \times \left(\frac{e}{b \times t} + 1 \right)^f \times \sum_3^t \frac{h}{t} \times p + Ri_{native} \times \prod_8^t \left[\frac{z \times (t-1)}{b \times t} + u + 1 \right] \quad (1)$$

43 In this formula, three factors are considered to determine the willingness of people
 44 studying a language, which are an economic strength, business potential and cultural
 45 influence. Birth rate and the death rate is considered to calculate the change in some native
 46 speakers of a language.

47 We realise that before we are figuring out where to open international offices, trends
 48 in global languages are needed. This model is used for forecasting the trends, and we made
 49 a table to show the ranking of using rate of languages over 50 years changing (Table 1).
 50 Then we find the geographic distribution of languages by analysing the number of
 51 languages used in a region and the situation of the world population migration. Our model
 52 is used to predict whether the migrants would spread their languages in a new region. By
 53 considering the geographic distribution of languages, locations of international offices can
 54 be chosen.

55 Under our analysis, we recommend the company open four new international offices
 56 in Hong Kong, Dubai, Britain and South Africa.

57

58 **Table 1.** List of languages by a total number of speakers (*Retrieved from*
 59 *https://en.wikipedia.org/wiki/List_of_languages_by_total_number_of_speakers_on*
 60 *January 17, 2018.*).

Native Language Rank	Native Language	Family	Second (or 3 rd , etc.) Language Speakers	Second Language Rank	Total
1	Mandarin Chinese (Inc. Standard Chinese)	Sino-Tibetan, Sinitic	193 million	4	1.09 billion
2	Spanish	Indo-European, Romance	91 million	8	527 million
3	English	Indo-European, Germanic	611 million	1	983 million
4	Hindustani (Hindi/Urdu)	Indo-European, Indo-Aryan	215 million	2	544 million
5	Arabic	Afro-Asiatic, Semitic	132 million	6	422 million
6	Bengali	Indo-European, Indo-Aryan	19 million In Bangladesh (2011)	13	261 million
7	Portuguese	Indo-European, Romance	11 million	15	229 million
8	Russian	Indo-European, Slavic	113 million (2010)	7	267 million
9	Punjabi	Indo-European, Indo-Aryan	?	?	148 million
10	Japanese	Japonica	1 million (2010)	19	129 million

61 3. Definitions

62 These definitions below help to explain the formulae.

- 63 ● **N** The total number of people using a language.
- 64 ● **$Ri_{non-native}$** The initial number of 2nd (or 3rd, etc) Language Speakers in... the first
 65 year.
- 66 ● **$Ri_{n\ in\ native}$** The initial number of native language users in the first year.
- 67 ● **t** The sample years selected.
- 68 ● **a** The sum of the GDP per head in every countries language as their mother tongue in
 69 t years.

- 70 ● **b** The number of countries using the language as their mother tongue.
- 71 ● **d** The sum of the world GDP per head in **t** years.
- 72 ● **e** The sum of growth the rate of GDP per head in the official countries in **t** years.
- 73 ● **f** The predicted years (50)-
- 74 ● **h** The number of people entering the official countries.
- 75 ● **T** The number of international tourism arrivals.
- 76 ● **p** the average literacy rate. This is considered by the level of average income in the
- 77 official countries.
- 78 ● **z** The sum of natural population increase growth rate in all the official countries.
- 79 ● **u** Initial natural population increase rate on average of official countries. It is different
- 80 with natural population increase growth rate, in other words, the first one is a change
- 81 rate(Δ).

82 **4 Assumptions**

83 *4.1 Growth rate*

84 Every growth rate including natural increase rate, the growth rate of GDP per head
 85 and literacy rate is constant during these years. We assume the predicted years are peaceful
 86 and the world economy develops normally.

87 *4.2 Native speakers*

88 Native people speak the native language. Newborns will one day speak the native
 89 language and native people leaving the world use native language.

90 *4.3 Non-native speakers*

91 We assume that people are learning a new language for only one particular purpose.
 92 They will not study a new language for both working abroad and studying abroad for
 93 example. They will not forget a language that they have already mastered.

94 *4.4 Family*

95 A language family is not considered into the model because it is not related to the
 96 questions.

97 5 Setting up a model

98 To analyse trends of global languages and languages distribution, the model illustrates
 99 the number of people using a language over time. The total using a number of a language
 100 is consist of the number of native speakers and the number of foreign speakers.

$$\mathbf{N} = R_{foreign} + R_{native} \quad (2)$$

101 We analyse each part of the total language users. Firstly, we consider the number of
 102 foreign speakers of a language. There are numerous factors influencing $R_{foreign}$, and
 103 three main factors are selected: the economic strength, cultural influence and business
 104 potential of the official countries.

105 ***Economic strength*** is an index that is calculated by using the average GDP per head
 106 between 2009-2016 of the official countries—the native of the particular language over the
 107 average GDP per head between 2009-2016 of the world.

$$R_{non-native} = Ri_{non-native} \times \frac{a}{b \times d} \quad (3)$$

108 This index reflects the difference of economic strength between official countries and
 109 the world average. If the value is greater than 1, the economic strength of the official
 110 countries is stronger than the world average. They are expected to have stronger power and
 111 higher potential to spread *their language*. *If the value is smaller than 1, the language*
 112 *development for this area is demanding*. This index is used to evaluate the power for
 113 languages development so that this is an important factor for discussion the language
 114 development in the short term.

115 ***Business potential*** is an index which is defined as the changing rate of the country's
 116 economic growth. It is used to predict the business development of the countries in the
 117 future. This index is obtained by measuring the annual economic growth rate of the official
 118 countries. We can predict the economic situation of the official countries in the future by
 119 following the trend. This indicator could help us to forecast the future economic situation
 120 more accurately. The reason why this index is involved is that it can measure the potential
 121 development of the economies of the official countries. We aim to forecast the language
 122 development for future 50 years, so we need to consider future potential. This indicator
 123 could help us to forecast the trends of the spreading of a language. Thus it is an important
 124 factor of the language development in the long term.

$$R_{non-native} = Ri_{non-native} \times \frac{a}{b \times d} \times \left(\frac{e}{b \times t} + 1 \right)^f \quad (4)$$

125 **Cultural influence** is a significant factor that can cause dramatic changes in the
 126 number of people studying a new language. As a consequence, we multiply the index that
 127 is calculated by using international tourism arrivals of the official countries and the average
 128 literacy rate of the official countries. We believe that the literacy rate is a fair indicator to
 129 measure the cultural influence. If more people in a country are educated, their cultures are
 130 more likely prevailing in the world. Therefore, there would be more people willing to
 131 master the language those countries use.

$$R_{non-native} = Ri_{non-native} \times \frac{a}{b \times d} \times \left(\frac{e}{b \times t} + 1 \right)^f \times \sum_3^t \frac{h}{t} \times p \quad (5)$$

132 There is a dominant factor, the birth of local babies, influencing the number of a
 133 native speaker of languages seriously. We try to predict the rate of natural increase by
 134 assuming the rate of natural increase growth around linearly, and the average annual
 135 changing rate of natural increase can be calculated:

$$Rate_{annual} = \frac{z}{b \times t} \quad (6)$$

$$Rate_{natural\ increase} = \frac{z}{b \times t} \times t - 1 + u \quad (7)$$

136 Subsequently, the number of the native speakers can get by adding the figure for
 137 original native speaker and newborn speaker.

$$Ri_{native} = \prod_8^t \left[\frac{z \times (t - 1)}{b \times t} + u + 1 \right] \quad (8)$$

138 Overall the total number N, using the language in the f year can be calculated by
 139 adding $R_{non-native}$ and R_{native}

$$N = Ri_{non-native} \times \frac{a}{b \times d} \times \left(\frac{e}{b \times t} + 1 \right)^f \times \sum_3^t \frac{h}{t} \times p + Ri_{native} \times \prod_8^t \left[\frac{z \times (t - 1)}{b \times t} + u + 1 \right] \quad (9)$$

140 We can use this model to predict the number of people mastering a particular language
 141 at any year in the future to get trends in global languages. By considering the final trends,
 142 economic growth and condition of current population migration, we can give relevant
 143 recommendations of location options for new offices.

144

145 **6 Trends of global language**

146 **Table 2.** Language ranking at present.

Rank	Native	overall
1	Chinese	Chinese
2	Spanish	English
3	English	Hindustani
4	Hindustani	Spanish
5	Arabic	Arabic
6	Bengali	Malay
7	Portuguese	Russian
8	Russian	Bengali
9	Punjabi	Portuguese
10	Japanese	French

147 **Table 3.** Language ranking after 50 years.

Rank	Native	overall
1	Chinese	Chinese
2	Spanish	English
3	English	Spanish
4	Arabic	Hindustani
5	Hindustani	Arabic
6	Bengali	Malay
7	Hausa	Hausa
8	Russian	Bengali
9	Portuguese	Russian
10	Malay	French

148 The two tables illustrate the current top-ten list and the future top-ten list of the
 149 language popularity. We find that there are changes of the rank. We predict that Malay and
 150 Hausa will enter the native list after 50 years. Japanese and Punjabi will fall out. Arabic
 151 will have a higher rank after 50 years due to the staggering net population increase in
 152 Arabia. Languages including Hindustani and Portuguese will lose their original position
 153 and will be ranked at 5 and nine respectively. India is operating family planning in their
 154 country, so the increase of native speakers is decelerated. Countries using the Portuguese
 155 are having a decrease in net population growth too. This situation is more serious in Japan,

156 where the net population increase is negative during these years, and if this problem in
157 Japan is not solved, native speakers of Japanese will decrease steeply. Conversely, the
158 native rank of languages that have stable and positive net population increase rate in the
159 official countries have increased. The overall ranking would change over the next 50 years.
160 Portuguese will fall out of top-ten because of the low economic growth rate, which is a
161 factor affecting the number of people studying a new language, these years in the official
162 countries on average. Portugal is even experiencing an economic recession, and the trend
163 shows this recession may continue. Hindustani and Spanish exchange their ranks due to
164 the fall in some native speakers of Hindustani. The similar consequence happens in Russia
165 too. Furthermore, Russia's GDP per head and economic growth rate is not that high, so the
166 overall rank of Russian decreased from 7 to 9 after 50 years. Surprisingly, Hausa would
167 come into the ranking. The population is growing rapidly in Africa so that we predict the
168 number of people speaks Hausa will increase a lot.

169 According to the data that is found in The World Bank Database, Sudan, Spain,
170 Arabia, India, Bangladesh, China, Pakistan, Indonesia, Sri Lanka and Kuwait are in the
171 front rank of immigrant countries. Then we start to look up the official languages of these
172 countries, which might be propagated to other regions by migrants. These official
173 languages are Hausa, Swahili, Spanish, Arabic, Hindustani, Bengali, Chinese and Malay
174 etc. After that, we try to found the destination of the migrations by searching countries
175 which are in the front rank of immigration each region, such as Germany , Turkey, Russia
176 and The U.K in Europe, The USA, Canada in Americas and New Zealand, Australia in the
177 Oceania, followed by deciding whether the language would spread as migration or not by
178 analysing trend of the language as we calculated before, because migration sometimes do
179 not represent the propagation of migrant's mother languages. This could be explained as
180 for the languages with decreasing trend; migrants might study other languages with
181 increasing trend instead of the spread of their mother languages. Thus, it is more likely for
182 the languages with a growth trend to spread to migrant countries. For example, Chinese,
183 Malay and Arabic tend to be spread to the Americas, Europe and Oceania by migration.
184 Spontaneously, migration promotes the mobility of languages. According to the difference
185 of GDP per head among nations of immigrants, the potential growth of a language in a
186 particular region can be reflected. Nation of immigrants including Britain, the USA,
187 Germany, Australia and New Zealand have stable economic growth, as a consequence,
188 these nation's languages have greater potential to migrate to those nations of emigrants.
189 Additionally, people in India, Bangladesh or China are likely to study languages from more
190 developed countries. Accordingly, many languages from Asia and Africa would spread to
191 Europe and North America. Overall, by a series of changing, Arabic, Chinese and Malay

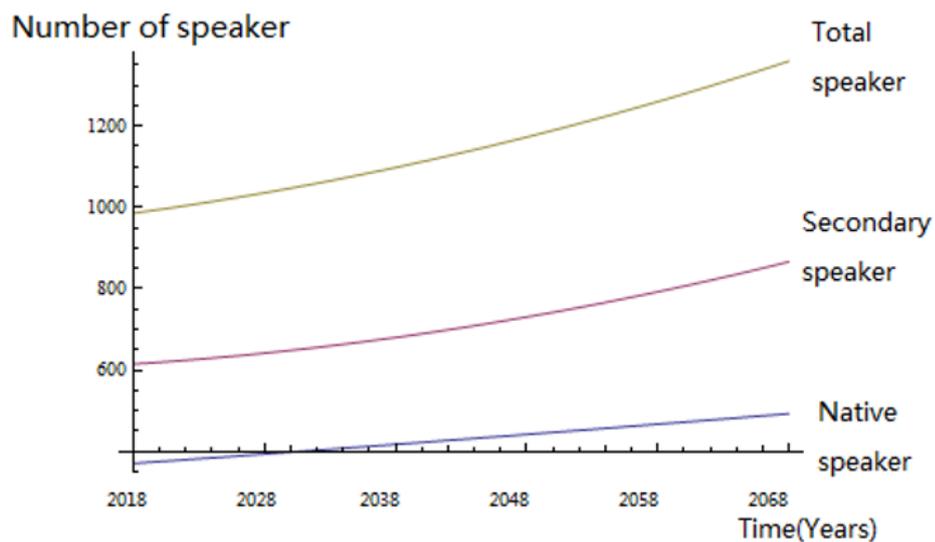
192 have great potential to propagate to North America, the UK, Australia and Russia. English
 193 will keep prevailing in the world.

194 7 Result

195 We use our model to predict the number of people speaking English after 50 years.
 196 By considering the change in some native English speakers and non-native English
 197 speakers several years ago, we can get the trends of English changing. After we get the
 198 trends, we can forecast the future change of English use.

199 We can see that the number of native speakers increased from xx to xx, so in the next
 200 50 years, this number would rise to xx. The number of non-native speakers is increased
 201 too during these years. By adding these two numbers together, we can get the total number
 202 of English speaker worldwide.

203 We try to draw a scatter line by calculating each year of the future 50 years. The
 204 process of calculation is executed by a computer program (Pascal) which is designed by
 205 us. The Figure 2, Figure 3 and Figure 4 show the source code of the program and value we
 206 got each year.



207

208

Figure 1. The trend of English.

```

var xxxxx:string;
    l,ooo,aaa:real;
procedure nativespeaker;
var v,u,d,k,t,a,n:real;
    i:integer;
begin
    t:=0;
    l:=371;
    for i:=1 to 50 do
    begin
        k:=-0.00011241;
        n:=1*(k*t+0.042695/7);
        l:=n+1;
        t:=t+1;
        writeln(i,l)
    end;
    writeln('number of native speakers:',l);
end;

procedure secondaryspeaker;
var b,c,d,e,y,f,x,h,t,w,p,n,r:real;
    a:integer ;
begin
    b:=1;
    for a:= 1 to 50 do
    begin
        ooo:=611*4.201*0.98*0.05*exp(b*ln(1+0.022508))+485.23;
        writeln(a,ooo);
        b:=b+1;
    end;

    writeln('number of secondary speakers:',ooo);
end;

begin
    nativespeaker;
    secondaryspeaker;
    aaa:=ooo+1;
    writeln(aaa);
    readln;
end.

```

209

210

Figure 2. The process of calculation.

```

C:\Users\apple\Desktop\新建文件夹\english.exe
1 3.7326283500000000E+002
2 3.7549751320190694E+002
3 3.7770336046901110E+002
4 3.7987970827550646E+002
5 3.8202589404130930E+002
6 3.8414126146557675E+002
7 3.8622516005869336E+002
8 3.8827694947249159E+002
9 3.9029599182847397E+002
10 3.9228166004380341E+002
11 3.9423333415482961E+002
12 3.9615040243791958E+002
13 3.9803226172736117E+002
14 3.9987831773010964E+002
15 4.0168798533714892E+002
16 4.0346068893123976E+002
17 4.0519586269082976E+002
18 4.0689295088990133E+002
19 4.0855140019353608E+002
20 4.1017069994897656E+002
21 4.1175030247196867E+002
22 4.1328970332817039E+002
23 4.1478840160941667E+002
24 4.1624590820463135E+002
25 4.1766174606518297E+002
26 4.1903545046448227E+002
27 4.2036656925162504E+002
28 4.2165466309888626E+002
29 4.2289930574287678E+002
30 4.2410008421917752E+002
31 4.2525659909027058E+002
32 4.2636846466659176E+002
33 4.2743530922053316E+002
34 4.2845677519323038E+002
35 4.2943251939397339E+002
36 4.3036221319200511E+002
37 4.3124554270111878E+002
38 4.3208220095522891E+002
39 4.3287192807757759E+002
40 4.3361443144064367E+002
41 4.3430946581830801E+002
42 4.3495679352959462E+002
43 4.3555619257395341E+002
44 4.3610745675797716E+002
45 4.3661039581345136E+002
46 4.3706483550664240E+002
47 4.3747061773873679E+002
48 4.3782760063734986E+002
49 4.3813565863903028E+002
50 4.3839468256269345E+002
number of native speakers: 4.3839468256269345E+002

```

211

212

Figure 3. The value calculated of a native speaker.

```

C:\Users\apple\Desktop\新建文件夹\english.exe
1 6.1383465431741195E+002
2 6.1672928787678836E+002
3 6.1968907384831903E+002
4 6.2271547868249706E+002
5 6.2581000183668266E+002
6 6.2897417651802277E+002
7 6.3220957044309034E+002
8 6.3551778661462345E+002
9 6.3890046411574542E+002
10 6.4235927892206257E+002
11 6.4589594473204033E+002
12 6.4951221381606911E+002
13 6.5320987788464129E+002
14 6.5699076897606869E+002
15 6.6085676036418204E+002
16 6.6480976748645912E+002
17 6.6885174889304437E+002
18 6.7298470721712897E+002
19 6.7721069016717206E+002
20 6.8153179154145482E+002
21 6.8595015226546991E+002
22 6.9046796145266103E+002
23 6.9508745748903755E+002
24 6.9981092914220085E+002
25 7.0464071669533348E+002
26 7.0957921310671202E+002
27 7.1462886519531787E+002
28 7.1979217485313416E+002
29 7.2507170028472854E+002
30 7.3047005727473720E+002
31 7.3598992048387697E+002
32 7.4163402477412808E+002
33 7.4740516656374416E+002
34 7.5330620521276091E+002
35 7.5934006443968974E+002
36 7.6550973377009825E+002
37 7.7181827001779561E+002
38 7.7826879879935609E+002
39 7.8486451608273205E+002
40 7.9160868977072221E+002
41 7.9850466132008160E+002
42 8.0555584739707399E+002
43 8.1276574157028733E+002
44 8.2013791604155131E+002
45 8.2767602341581460E+002
46 8.3538379851085779E+002
47 8.4326506020774013E+002
48 8.5132371334289599E+002
49 8.5956375064281781E+002
50 8.6798925470228642E+002
number of secondary speakers: 8.6798925470228642E+002

```

213

214

Figure 4. The value calculated for the secondary speaker.

215 8 Sensitivity to parameters

216 8.1 Strengths

- 217 1. This model considers several factors that involve the official countries' economic
 218 strength, business potential and culture influence. This consideration includes short-
 219 term effects, long-term effects and potential effects.
- 220 2. All the factors that we considered in our model are indices that have generality, thus
 221 by using the formulae, trends of a language is highly predictable.
- 222 3. All the indices are calculated using the real data that are collected from the World
 223 Bank Database from 2009 to 2016. The data are reliable enough for us to build the
 224 model.

225 8.2 Weaknesses

- 226 1. Not all the information is included in our calculation, only representative data is
 227 considered.
- 228 2. Need to collect data. We act as consultants for an international company, so we must
 229 collect data.
- 230 3. Only the country's net population increase rate is considered as a factor when we
 231 calculate figure for native speakers. There might be some potential factors affect the
 232 accuracy of our result.

233 9 Suggestion

234 For selecting appropriate locations, we create a model using for predicting the trends
 235 of globalisation. The model can calculate the number of people mastering a language in
 236 the world, and by analysing the patterns of languages people mastered, we can predict the
 237 trend of international development. Then following this trend to determine the locations
 238 your company should choose. In our model, population change in the official countries is
 239 considered. Because most people in the world are likely to study another language,
 240 economic growth and cultural influence of the countries are considered as well.

241 Finally, we choose six places as our recommendation of locations to set the offices.
 242 They are New Zealand, the United Kingdom, the United States of America, China Hong
 243 Kong, South Africa and the United Arab Emirates. The reasons why these places are
 244 chosen are:

245 *i. New Zealand*

246 We recommend that the office should be operated in New Zealand, because of its
 247 export value and GDP per head come out top in Australia, and it is assessed as one of the
 248 countries with the most suitable region for doing business by The World Bank. The data

249 above shows that the economy of New Zealand is burgeoning, so the company has a
250 substantial number of demand. Also, the tourism business and globalisation of New
251 Zealand is highly developed. Thus, it attracts visitors from all over the world which allows
252 our company to be multinational. Regarding its neighbour, Australia and New Zealand
253 have the same official language of English; workers are supposed to have the ability to
254 speak English fluently to face frequent trade between New Zealand and the world.
255 Furthermore, its government has corresponding laws that ensure the stable development
256 of the company in the long term.

257 *ii. South Africa*

258 We suggest that company should investigate an office in South Africa as a hub to
259 connect Africans. Firstly, South Africa is the most developed country in Africa; its
260 economy tends to grow constantly. It is profitable for the office operating in a developing
261 economy. Secondly, it has 'the one official languages' staffs are supposed to master
262 English, Hausa and Swahili, which are the main component of their daily usage. Our
263 research shows that the number of the three language speakers are expected to increase
264 significantly because of business promotion and a considerable number of migrations. As
265 a result, the South African marketing is potential for expansion. This could be explained
266 as the popularity of the three languages could bring substantial arrivals for different
267 purposes, such as travelling or international trades. Also, there are abundant mineral
268 resources such as gold, diamond and iron, which are capable of supplying the African
269 business operation and stimulation.

270 *iii. The United Kingdom London*

271 It is an appropriate place to set off an office. As a leading economy in Europe, the
272 U.K. has always been attracted much attention. It is said that setting up an office in London
273 is predicted to offer a great opportunity for international communication. According to the
274 World Bank database, London has an average annual GDP per head that is nearly four
275 times the world's average. Thus it is the centre of international trade and the tourist
276 attraction. Setting an office in London can achieve our client's aims. Furthermore, the
277 government has promulgated relevant decrees to ensure that companies can have stable
278 developments. The decision made by British to leave the EU does have some short-term
279 impacts on companies. However, Britain has attracted lots of international students who
280 speak English as a mother tongue. Britain is considered as a country that teenagers with
281 high intelligence can spark a revolution and fully achieve their potential in each territory.
282 The staff in this office may master Chinese, French and some other languages apart from

283 English because of Chinese ranks 4 in the most popular language. Meanwhile, China has
284 rapid economic growth, and most of the Chinese students look for the university in the
285 United Kingdom, causing the growth of the trend of Chinese students living in London.
286 France is the closest country near the United Kingdom and has a long history and abundant
287 cultures. As a result, it is possible for some French to live in the United Kingdom. This
288 office may also serve some other language speakers due to that the London is one of the
289 famous metropolitans all over the world. Thus, the staffs are supposed to master some other
290 popular languages to face the frequent international meetings. We forecast that the office
291 in London will grow up at a fast-stable rate with some possibilities for expansion because
292 this city has nearly constant annual economic growth which stays at 4

293 *iv. China Hong Kong*

294 The GDP per head of Hong Kong is seven times much as that of global. Hong Kong
295 gathers multiculturalism; thus, workers are supposed to speak English and several another
296 language. Firstly, English and Cantonese are commonly used in daily routine. Secondly,
297 the considerable number of arrivals, which contains Chinese, Japanese e and South Korea,
298 might contact the company with different aims, their main language is often used. For,
299 example, the short distance between Hong Kong and the Chinese Mainland is bound to
300 frequent visiting. South Korea and Japan have developed economies in Asia, trade between
301 them and Hong Kong cannot be avoided. Apart from this, the company can treat the office
302 as a hinge in Asia to operate in Asia smoothly. Furthermore, because of the stable
303 development of Hong Kong's economy and its surroundings, Hong Kong's
304 marketing is expected to expand.

305 *v. The United States of America*

306 Our client can set another office in Los Angeles in the United States. The annual GDP
307 per head in the US is nearly five times the world's average. It shows that the US is a pioneer
308 of the world economy. Economic success would help the company to be more profitable.
309 Also, according to the World Bank database, the US has the largest number of immigrants.
310 It is a truly multicultural centre, which means that the company can be international.
311 America enabling thousands of people travelling its cities each year, setting office in the
312 United States could enlarge the service internationally. The average annual GDP per head
313 growth rate in the USA is stood at 2 per cent, which means the United States has stable
314 inflation and is being a pioneer of economic development around the world. This figure
315 shows that the United States has an optimistic future perspective. Furthermore, the United
316 States has advanced technologies. In many aspects, the United States is in the world top.

317 As a result, setting an office in the United States would be a great idea. English is an official
318 language in the United States; any languages could come in handy since people from
319 different places are gathered in this great country. The staff should master languages apart
320 from English as much as possible. Although you already have an office in New York City,
321 for the purpose to be international, opening another office in Los Angeles is feasible.

322 *vi. The United Arab Emirates*

323 Since the company aims to be more international, the company should pay attention
324 to the metropolitans all over the world. Dubai is an appropriate choice because of Arabia
325 is an important economy in the world, so that entrepreneurs should not ignore this region.
326 Furthermore, Arabia has abundant oils and mines which are promoters to maintain the
327 stable annual economic growth in this region. Arabia has greater markets that can be
328 expanded, and in the short term, the aim of your company would perform well. Arabic is
329 the fifth popular language all over the world. Thus employees in this office need to master
330 English and Arabic for communication with local people and others in the world. Dubai is
331 the represent metropolitan in Arabia, so setting an office in Dubai is considerable.
332 Nevertheless, due to religious and political issues in Arabia, it is easy to imagine that
333 fluctuations may occur there. As a consequence, long-term changes would happen. If it is
334 possible, we recommend you open four international offices instead of 6. You aim to make
335 your company more international. Opening international offices in New Zealand can be
336 cancelled because of people in Oceania speak English, so services provided by the office
337 in New Zealand face to English users. The official language in Australia and New Zealand
338 is English, so employees in the office only need to master English. Overall, opening an
339 international office in New Zealand is unnecessary. You said that your company already
340 has an office in New York City, so another office in the USA is unnecessary too if your
341 aim is only to become international.

342 **10 Conclusion**

343 Our trends predicting model gives valuable information about the number and
344 mobility of a language. By analysing the trends of languages, we can decide where to open
345 new international offices to help your company become truly international. In conclusion,
346 if necessary to open six new offices, we recommend you to open in China Hong Kong,
347 South Africa, Dubai in the United Arab Emirates, London in Britain, New Zealand and
348 Los Angeles in the United States of America. If your company aims to save company

349 resource, then the new offices in New Zealand and Los Angeles are considered to be
350 cancelled.

351 **Author Contributions:** For research articles with several authors, a short paragraph
352 specifying their individual contributions must be provided. The following statements
353 should be used “Conceptualization, X.X. and Y.Y.; Methodology, X.X.; Software, X.X.;
354 Validation, X.X., Y.Y. and Z.Z.; Formal Analysis, X.X.; Investigation, X.X.; Resources,
355 X.X.; Data Curation, X.X.; Writing-Original Draft Preparation, X.X.; Writing-Review &
356 Editing, X.X.; Visualization, X.X.; Supervision, X.X.; Project Administration, X.X.;
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359 reported.

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375 interpretation of data; in the writing of the manuscript, and in the decision to publish the
376 results”.

377 **Appendix A**

378 The appendix is an optional section that can contain details and data supplemental to
379 the main text. For example, explanations of experimental details that would disrupt the
380 flow of the main text, but nonetheless remain crucial to understanding and reproducing the
381 research shown; figures of replicates for experiments of which representative data is shown

382 in the main text can be added here if brief, or as Supplementary data. Mathematical proofs
383 of results not central to the paper can be added as an appendix.

384 **Appendix B**

385 All appendix sections must be cited in the main text. In the appendixes, Figures,
386 Tables, etc. should be labeled starting with ‘A’, e.g., Figure A1, Figure A2, etc.

387 **References**

388 In the text, reference numbers should be placed in square brackets [], and placed before
389 the punctuation; for example [1], [1–3] or [1,3]. For embedded citations in the text with
390 pagination, use both parentheses and brackets to indicate the reference number and page
391 numbers; for example [5] (p. 10), or [6] (pp. 101–105).

392

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