7th World Conference on Educational Sciences, (WCES-2015), 05-07 February 2015, Novotel Athens Convention Center, Athens, Greece

# Business Forecasting Technique on Mobile Devices by Using R - Programming

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**Abstract**

This study aims to develop business forecasting technique on Mobile Devices by R – Programming. The researcher has developed the learning resource by utilizing C++ Builder 2009 program, enhanced by R - Programming: concerning database with Microsoft Access 2007. The data were collected in Exponential Smoothing, Holt - Winters, and ARMA Model including an explanation, examples, calculation, and application for business. The evaluation on quality and convenience of the media, based on 30 students who interested in business forecasting, revealed that the quality of the resource regarding the informational system is on effective level.

## 1. Introduction

Business environment is changing with increasing complexity. The business competition is tougher and more difficult than a former time. It enforces the enterprise's role to use more information which is rapidly and accuracy for decision-making.

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**Nomenclature**

ARMA  Mixed Autoregressive Moving Average Model

Forecasting is an important process and broadly considered as a technique for estimating many future aspects of a business. It can help the company plan for the future and make more rational decisions. For this reason, the demand for mastery forecaster is increasing so the graduates who involve in business, economics, and statistics curriculum will certainly study in forecasting course (Loomis and Cox, 2003). It bridges the gap between an abstract statistics and the real world applications by providing the prediction models which statistics are used. Forecasting technique concepts are complex, abstract and computational difficulties. Problems with statistics learning are universal. Most students encounter difficulties in their statistics education.

R-programming is an effective and popular program for statistical analysis. In addition, it can download with no charge (freeware). The program provides in the Object Oriented Language category and interactively functioning. Furthermore, users are able to desire their own functions for a specific purpose including graphics (Venables et al., 2006). Moreover, users can process data stored in several programs such as Excel, SPSS, and SAS with R-program. That ability is extremely useful for researcher.

The advancing technology and technology-based such as social network, internet, and mobile devices change the public experiences and expectation for accessing and sharing knowledge (HEFCE, 2010). Higher education institutions are presently challenged to look for an innovative way to develop their faculties. Mobile learning (M-Learning) is the new learning environment using wireless transmission and mobile devices such as PDAs, laptops and mobile phones. The finding of a survey of US college students, faculty and IT staff (CDW-G, 2010) pointed that students use the technologies such as mobile devices, blog, and podcasts in their lives and are largely absent from the classroom. In addition, Apichatibutarapong (2014) highlighted those students' opinions which study the online learning resource in Applied Statistics course by using mobile devices are good level in content and presentation, accuracy, flexible and easy usage. Educators should be up to date and employ mobile technologies to rethink their teaching to deliver knowledge according to students' lifestyle. Lecturers need to provide more online learning for supporting the creation of student communities of interest and disseminates information associated to the academic life.

*1.1. Business Forecasting*

Forecasting is an ordinary statistical task in businesses which minimize uncertainly, identify, and evaluate risk. It helps to inform decisions and provides a guideline to long-term strategic planning about scheduling of production, transportation, future sales, raw material purchasing plan, and policies regarding inventories. The poor forecasts may lead to poor planning and increase business costs.

The business environment is changing with increasing complexity. Makridakis et al. (1983) noted several factors which have caused the importance of forecasting such as the increasing complexity of organizations (e.g. number of submarkets served and products offered) and business environment, demand and technology change, and more systematic decision making. Armstrong (1988) also pointed out that the demand for research on forecasting is strong. All businesses will need to require an analysis of the competition, forecasting becomes an essential discipline for running business especially for planning strategies and making decisions on any operations in any professional fields. If the decision-makers are able to forecast upcoming circumstances at a certain level of reliability with high accuracy rate, the plan and the operation will flow as or above expected. Loomis and Cox (2003) indicated that the demand for forecaster is going up. It is driven the institutions must concern forecasting course.

Hyndman (2009) showed that modern organizations require three types of forecasts such as short-, medium-, and long-term forecasts, depending on their applications. Short-term forecasts are required for scheduling of personnel, production, and transportation. Medium-term forecasts are desired to determine future resource requirements in order to purchase raw materials, recruit employee, or buy equipment. Long-term forecasts are used in strategic planning, taking account of market opportunities, environment factors and internal resources.

Forecasting methods can be divided into two categories: qualitative and quantitative (Sahu). Many forecasting techniques use the historical time series data including any knowledge of events that might impact the forecasts. A

time series is a set of observation measured in a continual periods of time. Qualitative forecasting technique basically employs the judgment of the appropriate experts to generate forecasts. The advantage of this procedure is applied when the historical data are not available or environmental conditions affecting the time series. Three significant qualitative forecasting methods are: Delphi technique, scenario writing, and the subject approach. Delphi technique attempts to develop forecasts through "group consensus". The experts are unknown to each other and a panel of experts is asked to respond to a series of questionnaires. Then each expert is asked to reconsider and revise his/her initial answer. Thos process is continued until some degree of consensus among experts is reached. Scenario writing, the forecasters start with different sets of scenario of business outcome. They would be able to generate many various future scenario which corresponding the set of assumptions. Then the decision maker is present with the different scenarios and has to decide which scenario is most likely to prevail. The subjective approach allows individuals participating in the forecasting decision to reach the forecast based on their subjective feelings and ideas. Brainstorming is frequently used to develop the new ideas or solve the complex problems.

Quantitative forecasting methods are based on analysis of historical data concerning time series of the specific and interest variables. Time series are comprised of four components: trend, seasonal, cyclical, and irregular component. A trend emerged due to one or more long-term factors for examples, population size changed, change of population demographic characteristics, and customers change in taste and preference. The cyclical component is the deviation of the observation from the trend due to cyclical fluctuations (e.g. business cycles). The seasonal component is similar to cyclical component but the variability of time series due to seasonal fluctuations (e.g. spring, summer, autumn, and winter). The irregular component represents the residual and random variation in an observation caused by short-term, unanticipated factors that affect the time series. There are various quantitative methods such as Decomposition, Smoothing technique, Box&Jenkins, etc. In this paper, the researcher emphasizes study in quantitative forecasting technique.

Because of forecasting requires the strong statistical task and mathematical modeling for information pertaining to predictions. Furthermore, we do not assume anything about the students' statistical knowledge background in the forecasting classes. The range of students' statistical experienced could vary from none to mastery achievement. Many of statisticians and researchers have developed forecasting software from 1960s up to the software reaches a stage where everyone with no technical training can benefit from it (Kusters, 2006). The more efficient forecasting software is, the more costs is provided.

### 1.2. Mobile learning

"Mobile" refers to the potentially of activities taking place in numerous locations, across varied times, and accessing various content with multiple equipment such as tablets and smart phones (Keegan et al., 2006). As wireless technologies development and mobile devices are becoming increasingly ubiquitous, many researchers and educators have aggregated this technology into their teaching and learning environment.  Mobile devices are widespread in our daily lives, providing unparalleled access to communication and information. Cisco, 2012) indicated that the number of mobile devices was estimated to exceed the world's population by the end of 2012.

Mobile learning is defined as learning facilitated by mobile devices (Mobile Learning Network (MoLeNET), 2009). Mobile devices allow learners to access content and communicate with classmates and instructors (Cavus, Bicen, & Akcil, 2008). In addition, mobile technologies enable learners to find, identify manipulate, and evaluate existing knowledge (Brown, 2005).

A development of mobile technology provides several of opportunities to support learning both inside and outside the classrooms. According to the potential of mobile devices, they can support learning in new ways. Greenhow (2011) summarized that using social media tools in learning promotes a more student-centered course. Furthermore, Gikas and Grant (2013) found that the advantages of mobile devices for student learning are 1) accessing information quickly, 2) communication and content collaboration, 3) variety of ways to learn, and 4) situated learning. It caused that mobile learning has become a new educational paradigm of learning via mobile technology. Moreover, teaching and learning can be carried out at anyone, anytime and anywhere. As mobile technologies advance and the concept of mobile learning gain traction world, these goals are useful starting points for aligning mobile learning objectives with the wider UNESCO policy agenda (Shuler, Winters, &West, 2013).

## 2. Research objectives

The objectives of this study are
i.    to develop business forecasting technique by using R-Programming and integration mobile technology and devices to create a new strategy for learning environment
ii.   to evaluate on quality and convenience for business forecasting technique on mobile devices by using R-Programming


## 3. Research Methodology

### 3.1. Participants

This study has been carried out at Suan Sunandha Rajabhat University (SSRU) involving 30 volunteer students were randomly selected. The participants were both genders, 19-21 yrs-of age and interested in Forecasting Technique. They were invited to practice with the learning media with no limit on usage time.

### 3.2. Material and Instrument

The business forecasting technique on mobile device by using R-Programming was developed by using C++ Builder 2009 enhanced by R-program for applying applications and managing database system by Microsoft Access. The learning media of business forecasting technique procedure is following steps: 1) Data collection for developing the statistical analysis in forecasting technique by applying R-program with quantitative method such as Exponential Smoothing Model, Holt-Winter Model, and ARMA 2) Database design 3) Database and application establishment 4) Implementation and 5) Evaluation.

The appropriateness assessment of the business forecasting technique learning material contained 3 aspects: Content and presentation (7 items), Font and color (6 items), and Technical media production (10 items). A 5-point Likert scale was used. The options are 5-Very effective, 4-Effective, 3-Average, 2-Ineffective, and 1-Very ineffective. The quantitative approach was used to investigate the descriptive statistics of the evaluation survey. The quality classification level of learning media is defined as shown in Table 1.

Table 1. Rating of quality evaluation

| Mean | Quality Classification. |
|---|---|
| 4.50 – 5.00 | Very effective |
| 3.50 – 4.49 | Effective |
| 2.50 – 3.49 | Average |
| 1.50 – 2.49 | Ineffective |
| 1.00 -1.49 | Very ineffective |


## 4. Results

In assessing the descriptive statistics concerning quality of learning resource for business forecasting technique on mobile devices by using R-Programming, the study discovered that the students' opinions were effective in overall and each factors: 1) content and presentation 2) font and color, and 3) technical media production except in item 3.10, the evaluation was average ($\overline{x}$ = 2.50).

Table 2. Quality of Business Forecasting Technique on Mobile devices by Using R-Programming

| Items | $\overline{x}$ | S.D. | Assessment |
|---|---|---|---|
| **I. Content and Presentation** | **3.78** | **0.54** | **Effective** |
| 1.1 Clarity in describing the content | 3.83 | 0.81 | Effective |
| 1.2 Amount of content | 3.83 | 0.81 | Effective |
| 1.3 Sequence of content | 3.67 | 0.98 | Effective |
| 1.4 Accuracy of content | 4.00 | 0.63 | Effective |
| 1.5 Accuracy of language used | 3.67 | 0.75 | Effective |
| 1.6 Appropriate in style and presentation | 3.83 | 0.40 | Effective |
| 1.7 Appropriateness of the content presented in each episode | 3.67 | 0.51 | Effective |
| **II. Font and Color** | **4.02** | **0.76** | **Effective** |
| 2.1 Format of font used | 4.00 | 0.63 | Effective |
| 2.2 Size of font used | 4.00 | 0.89 | Effective |
| 2.3 Clarity of text | 4.17 | 0.89 | Effective |
| 2.4 Color of text | 4.00 | 0.75 | Effective |
| 2.5 Color of Background | 4.00 | 0.89 | Effective |
| 2.6 Overall color of screen | 4.00 | 0.89 | Effective |
| **III. Technical media production** | **3.78** | **0.54** | **Effective** |
| 3.1 Screen overall design | 3.67 | 0.51 | Effective |
| 3.2 Appropriateness of the size of the command button | 3.83 | 0.40 | Effective |
| 3.3 Interpretation of the language | 4.00 | 0.40 | Effective |
| 3.4 Speed and accuracy of searching information | 4.33 | 0.51 | Effective |
| 3.5 Availability of the input to the calculation. | 3.83 | 0.75 | Effective |
| 3.6 Speed and accuracy of the Statistical data analysis | 4.00 | 0.98 | Effective |
| 3.7 Flexibility in use | 3.83 | 0.63 | Effective |
| 3.8 Suitability of the design of the home page | 4.00 | 0.75 | Effective |
| 3.9 Simple and easy to use clicking buttons. | 3.83 | 0.63 | Effective |
| 3.10 Suitability of the operating instructions and web board | 2.50 | 1.64 | Average |
| **Total** | **3.84** | **0.49** | **Effective** |

From Table 2, the highest average of students' opinion was 4.33 in speed and accuracy of the statistical analysis and the lowest average was 2.50 in suitability of the operating instructions and web board.


## 5. Conclusion

According to the quality of the development of business forecasting technique on mobile devices by using R-programming, it indicated that the educational media via mobile technologies achieved a effective level based on students who interested in business forecasting technique. The research finding affirms and realizes as UNESCO pointed that in the twenty-first century, computers are viewed as a crucial component to learning, but mobile technologies will undoubtedly become more integrated and commonplace in both formal and informal education. (UNESCO, 2013).

This study was intended to be the starting point step for new strategies in learning business forecasting by using mobile technology. It would be beneficial to those looking for alternative strategies in learning statistics. For the further investigation, it should be expanded more effective and more business forecasting technique.

## Acknowledgements

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