ISSN 2278-3091
Volume 8, No.1.5, 2019
International Journal of Advanced Trends in Computer Science and Engineering
Available Online at http://www.warse.org/IJATCSE/static/pdf/file/ijatcse2281.52019.pdf
https://doi.org/10.30534/ijatcse/2019/2281.52019

A Study on Quality of Student Portal using Fuzzy AHP

Nur Solihah Khadhiah Abdullah[1], Nur Hafizah Mohamed[2], Ruhana Jaafar[3], Noor Erni Fazlina Mohd Akhir[4]
[1,2,3,4]Universiti Teknologi MARA (UiTM), Faculty of Computer and Mathematical Sciences, Cawangan Terengganu, Kampus Kuala Terengganu
nsolihah@uitm.edu.my; nurfieyzah23@gmail.com; ruhana75@uitm.edu.my; noore800@uitm.edu.my

ABSTRACT

Student portal has become one of the platforms that provides useful and important information to the students. With the increasing number of universities and colleges, it is vital to improve the quality of the portal as it will benefit the students. Accordingly, the purpose of this study is to evaluate the quality of UiTM Student Portal using Fuzzy Analytical Hierarchy Process (FAHP) between high and low experienced groups. This study also investigates the importance of the criteria and sub-criteria of quality by putting them in the ranking order. A number of UiTM students were selected as the evaluators to give their opinion on the quality of the portal. The quality was evaluated based on four criteria; service quality, system quality, information quality, and attractiveness of the portal and a few sub-criteria. A guided-interview session was administered, and the collected data was analyzed to rank the criteria. The result shows that there were some similarities and differences between high and low experienced groups of evaluators. The finding of this research is hoped to provide a valuable reference to the developer of UiTM Student Portal to enhance the portal performance, thus help students utilize the portal effectively.

Key words: Criteria, Fuzzy AHP, Quality, Student portal.

1. INTRODUCTION

Web portal has been used as a search engine and personalized online services. It is a website that promotes delivery of information, content aggregation, application and collaboration; all sent to the customers in a personalized manner [1]. The term "portal" which was adapted from seaport [2] infers a gateway for the delivery of goods from place to place. As for the web context, it describes an entry point for direct access to websites, contents, connection, commerce and community, which are the core functions of a portal.

Commercial portals, corporate portals, publishing portals and other personal portals are among the categories of portal that receive attention nowadays [3]. University portal is included in the corporate portal category that offers access to rich contents within personalized services and information required by the user [4].

Student portal has become compulsory at any academic institution in order to provide students with the right and enough information. It facilitates students to plan and look for the correct information in the simplest way. Therefore, the studies that can define the quality of web portal become significant to be done. According to [5], users' level of satisfaction can be expressed by identifying the quality of the portal. They suggested an integrated decision model for evaluating educational websites from the fuzzy subjective and objective perspectives.

Accordingly, the researchers suggested numerous methods and models in the study of website quality. [6] explored the models that have been developed by researchers in quality modelling of web portals. They reviewed a few models, together with the domains or attributes that influenced the quality. It was reported that conventional approaches were based on a crisp set, which was useful for precise data. Thus, they suggested fuzzy approach should be implemented in dealing with the uncertainty. [7] selected four main criteria with 16 sub-criteria in his study that focused on the evaluation of course website quality. While [8] indicated six criteria (including sub-criteria) that comprise system quality (accessibility, response time, and learnability), service quality (empathy) and attractiveness (webpage design and course design). [9] chose three main criteria with nine sub-criteria in their study that focused on hybrid MCDM model.

Users' maximum level of satisfaction will be the objective of the web portal service provider. The problems faced by users become the major concern; therefore students' responses are important to be analyzed. The main problem reported by the users of UiTM web portal is responsiveness. They tend to have problems to load the page during course registration period which involves adding and dropping courses. Users also have problems to login to the portal when it is done simultaneously by most of the students. Other than responsiveness, some students pointed out that, they have problems in course registration process because the system automatically logout when they click course registration button. This situation will disable them to choose certain classes due to the fixed number of students in each class which is set earlier. In accessing i-learn portal, students are also having problems to download notes using smartphones. Sometimes, downloaded files cannot be opened, perhaps due to the format of the uploaded file. These problems affect the initial functions of each tool in student portal, thus would lead to the ineffectiveness of the whole system.

In responding to the issues reported by users, the research that highlights the criteria or aspects that contribute to the

establishment of web portal is significant to be done. Assessing the quality or the effectiveness of the portal becomes crucial for both educators and researchers. Therefore, the purpose of this research is to evaluate the UiTM Student Portal by finding the weight for criteria and propose the ranking order. The study emphasized on two groups of evaluators, low and high experienced groups. This research focuses on the performance of Universiti Teknologi MARA Cawangan Terengganu (UiTMCT) in providing the facility by conducting the study on the quality of student portal. UiTM Student Portal (www.simsweb.uitm.edu.my) was established as a tool for service delivery and interaction with staff and the main user. This portal provides six functions; e-HEP system, e-Academic System, I-Learn Portal, Student Financial Service, Application Continuation Studies and iSiswa.

2. METHODOLOGY

Fuzzy Analytical Hierarchy Process (FAHP) was used in this study, limited to four main criteria and nine sub-criteria. Fuzzy concept offers a way to draw definite conclusions from vague or imprecise information [10]. Analytical Hierarchy Process (AHP) is a powerful method to solve complex decision problems. It is also an effective method that used weighthing and scaling techniques [11]. Any complex problems can be decomposed into several sub-problems using AHP in terms of hierarhichal levels. Each level signifies a set of criteria to each sub-problem.

2.1 Development of the hierarchical framework

This study comprises three levels of hierarchy; goal, criteria and sub-criteria (Figure 1). The chosen criteria were adapted from [7], and some adjustments were made to fit the objective of this research. Table 1 shows the criteria, sub-criteria and appropriate descriptions.

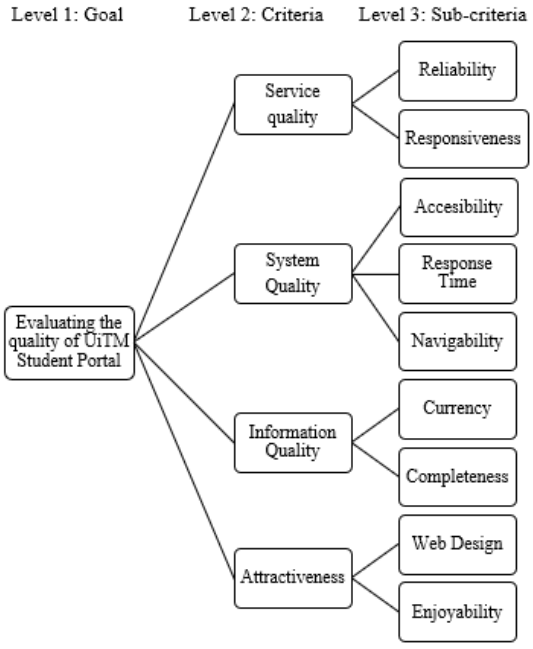

Figure 1: The hierarchy of criteria and sub-criteria

Table 1: Description of criteria and sub-criteria

CRITERIA/ SUB-CRITERIA & DESCRIPTIONS
Service Quality (C_1) Reliability (C_{11}) Responsiveness (C_{12}) Service quality deals with the whole support or maintenance provided by a portal. There are typical dimensions to mark the service quality, which are reliability and responsiveness. Reliability ensures the service to be trusted and provides accurate information and not merely publishes it. Responsiveness refers to promptness of a portal in providing helpful services to the users.
System Quality (C_2) Accessibility (C_{21}) Navigability (C_{22}) Response time (C_{23}) With regard to the user's control, system quality is the capability of a website to deliver suitable functions. The more quality a website has the more useful and functional it should be. Apart from becoming more convenient, system quality has certain values in order to remain as an important online measure system. Among the values being highlighted from the past studies are accessibility, navigability and response time. Accessibility is defined as user's capability to reach the materials on the website with least effort. Navigability provides user an easy navigation system which can prevent the website to lose track while searching, reduce searching time and increase user's satisfaction. Response time is about the speed of the website to respond to the request. Taking too long to respond is unfavorable among the users.
Information Quality (C_3) Currency (C_{31}) Completeness (C_{32}) Information quality is the quality of information provided by a website. Items are essential in terms of observing the quality of information provided by the online services. Among the most common items are accuracy and currency. The currency refers to the up-to-date information and precisely reflects the current state of the described information. On top of that, completeness represents the ability of the portal to provide all necessary information.
Attractiveness (C_4) Enjoyability (C_{41}) Web design (C_{42}) Attractiveness is crucial in providing fun and visually-pleasing web pages, giving clear indication to the users and leading them to enter the website. Multimedia capability is one of the attractive dimensions. It refers to multimedia features such as text, graphics, and video clips that can increase the users' preferences, fulfill individual needs and serve a better entity. Besides multimedia capability, webpage design is also a great factor to attractiveness. It could catch the user's interest by having sophisticated, attractive and organized appearance of the web page.

2.2 Design questionnaire and data collection

Based on the past research, the AHP-format questionnaire was designed with the focus on four main criteria and nine sub-criteria. Twelve evaluators were chosen to express their opinion towards the quality of UiTM Student Portal. Evaluators used linguistic variable to evaluate the importance of the criteria, starting from equally important to absolutely more important. Triangular and trapeziodal fuzzy numbers are commonly used due to their simplicity [12]. Thus, this study adopted triangular fuzzy number that denotes nine-level fuzzy linguistic variable (Table 2).

Table 2: Membership function of linguistic scale and corresponding fuzzy number

Scale	Meaning	Triangular Fuzzy Number
1	Equally important	(1,1,1)
2	Intermediate	(1,2,3)
3	Weakly more important	(2,3,4)
4	Intermediate	(3,4,5)
5	Strongly more important	(4,5,6)
6	Intermediate	(5,6,7)
7	Very strongly more important	(6,7,8)
8	Intermediate	(7,8,9)
9	Absolutely more important	(9,9,9)

2.3 Weight calculation for all criteria and sub-criteria

Five stepswise procedure to produce the weight were applied [13].

Step 1: Pairwise comparison based on linguistic judgement

Pairwise comparison matrices among all criteria were constructed. Linguistic terms were assigned to the pairwise comparisons by asking the evaluator which is more important between the two criteria, as shown in the following matrix **A**.

$$\tilde{A} = \begin{bmatrix} 1 & \tilde{a}_{ij} & \dots & \tilde{a}_{1n} \\ \tilde{a}_{21} & \dots & \dots & \tilde{a}_{21} \\ \dots & \dots & \dots & \dots \\ \tilde{a}_{n1} & \dots & \dots & 1 \end{bmatrix} \quad (1)$$

where

$$\tilde{a}_{ij} = \begin{Bmatrix} \tilde{9}^{-1}, \tilde{8}^{-1}, \tilde{7}^{-1}, \tilde{6}^{-1}, \tilde{5}^{-1}, \tilde{4}^{-1}, \tilde{3}^{-1}, \tilde{2}^{-1}, \tilde{1}^{-1}, \tilde{1}, \tilde{2}, \tilde{3}, \tilde{4}, \tilde{5}, \tilde{6}, \tilde{7}, \tilde{8}, \tilde{9}, i \neq j \\ 1, i = j \end{Bmatrix}$$

Step 2: Geometric mean of comparison value of criteria

According to [14], the geometric mean technique was calculated using the following formula:

$$\tilde{r}_i = \left(\tilde{a}_{i1} \otimes \dots \otimes \tilde{a}_{in}\right)^{\frac{1}{n}} \quad (2)$$

where $\tilde{a}_{ij}$ indicates the k[th] evaluator's preferences of i[th] criterion over j[th] criterion via triangular fuzzy numbers.

Step 3: Relative fuzzy weight of criteria

The following equation was applied to produce the fuzzy weight for each criterion.

$$\tilde{w}_i = \tilde{r}_i \otimes \left(\tilde{r}_1 \otimes \tilde{r}_2 \otimes \dots \otimes \tilde{r}_n\right)^{-1} \quad (3)$$

Step 4: Defuzzification, normalization and BNP (Best Nonfuzzy Performance) value

Next, the process of defuzzification [14] located the BNP value. This research applied centre of area (COA) method [15] in completing the defuzzification step due to its practicality.

$$M_i = \frac{lw_i + mw_i + uw_i}{3} \quad (4)$$

where M_i is nonfuzzy number and w_i is the fuzzy weight of criterion i. Then, the normalization process was performed using $b_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}}$ where b_{ij} is a normalized pairwise matrix and a_{ij} is the t^{th} decision maker's preference of i^{th} over j^{th} criterion.

Step 5: Establish the ranking order

By obtaining the BNP value, the ranking order can be established.

3. RESULT AND DISCUSSION

Pairwise comparison matrices were computed using (1) followed by the computation of the geometric mean using (2). The results obtained were shown in Table 3(a), 3(b) and 4.

Table 3(a): Pairwise comparison matrices for HE Group

Criteria	C_1	C_2	C_3	C_4
C_1	(1, 1, 1)	(2.82, 3.53, 4.19)	(1.05, 1.34, 1.82)	(2.33, 2.77, 3.16)
C_2	(0.24, 0.28, 0.35)	(1, 1, 1)	(1.17, 1.50, 1.85)	(1.48, 1.87, 2.36)
C_3	(0.55, 0.75, 0.95)	(0.54, 0.67, 0.85)	(1, 1, 1)	(0.71, 0.90, 1.12)
C_4	(0.31, 0.36, 0.43)	(0.42, 0.54, 0.68)	(0.89, 1.11, 1.40)	(1, 1, 1)

Table 3(b): Pairwise comparison matrices for LE Group

Criteria	C_1	C_2	C_3	C_4
C_1	(1, 1, 1)	(1.10, 1.21, 1.31)	(1.76, 2.36, 2.93)	(0.82, 1.07, 1.44)
C_2	(0.76, 0.83, 0.91)	(1, 1, 1)	(0.54, 0.63, 0.75)	(1.23, 1.54, 1.89)
C_3	(0.34, 0.42, 0.57)	(1.32, 1.59, 1.86)	(1, 1, 1)	(0.52, 0.66, 0.82)
C_4	(0.69, 0.93, 1.22)	(0.53, 0.65, 0.81)	(1.22, 1.51, 1.94)	(1, 1, 1)

Table 4: Geometric means of comparison matrices

Criteria/ Group	Geometric means, r	
	HE	LE
C_1	(1.6213, 1.6213, 1.9019)	(1.1219, 1.3214, 1.5347)
C_2	(0.8016, 0.8016, 0.9442)	(0.8417, 0.9464, 1.0665)
C_3	(0.6791, 0.6791, 0.8186)	(0.6954, 0.8168, 0.9642)
C_4	(0.5880, 0.5880, 0.6803)	(0.8187, 0.9789, 1.1787)
Total	(3.6901, 3.6901, 4.3450)	(3.4777, 4.0636, 4.7441)

Table 5: Relative fuzzy weight of criteria

Criteria/ Group	Fuzzy Weight, w	
	HE	LE
C_1	(0.3176, 0.3176, 0.4377)	(0.2365, 0.3252, 0.4413)
C_2	(0.1570, 0.1570, 0.2173)	(0.1774, 0.2329, 0.3067)
C_3	(0.1330, 0.1330, 0.1884)	(0.1466, 0.2010, 0.2772)
C_4	(0.1152, 0.1152, 0.1566)	(0.1726, 0.2409, 0.3389)

Table 6: Weight value and Ranking for criteria

Criteria/ Group	Weight value (Ranking)			
	HE		LE	
Service Quality (C_1)	0.4518	(1)	0.3343	(1)
System Quality (C_2)	0.2255	(2)	0.2390	(3)
Information Quality (C_3)	0.1955	(3)	0.2083	(4)
Attractiveness (C_4)	0.1627	(4)	0.2508	(2)

Table 7: Weights for sub-criteria

Main criteria/ Group	Sub-criteria/ Group	Final weight	
		HE	LE
Service quality	Reliability (C_{11})	0.4767	0.4839
	Responsiveness	0.6254	0.5436
System quality	Accessibility	0.3502	0.5050
	Navigability (C_{22})	0.2302	0.2931
	Response time	0.4606	0.2388
Information	Currency (C_{31})	0.3115	0.3903
	Completeness	0.6919	0.6465
Attractiveness	Enjoyability (C_{41})	0.4438	0.3470
	Web design (C_{42})	0.5607	0.6612

Table 6 shows the weight value for each criterion. The highest value for both groups is service quality, while the lowest for HE and LE groups are attractiveness and information quality respectively. To ensure the validity of the data collected, consistency test was done. According to [7], the data is consistent if the value of consistenty index (CI) is less than 0.1. For this study, the CI values obtained were 0.096725 (HE group) and 0.097508 (LE group), which showed the acceptable level of CI. The weight for sub-criteria is shown in Table 7.

The objective of this research is to measure the criteria that affect the quality of UiTM student portal among two different user groups. By utilizing the Fuzzy AHP to examine the quality of student portal, service quality was identified to be the first criteria that affect the quality due to its usability and efficiency in the portal for both user experience groups. The findings which matched with the previous research [16], [17] and [18] showed that users were satisfied with the overall support delivered by the student portal.

The results also indicated some differences between high and low experienced groups. The second ranking for high experienced group was system quality, followed by information quality and attractiveness. While, the ranking for low experience group indicated attractiveness criterion to be in the second ranking, followed by system quality and information quality. Users who have more online experience consider system quality to be the second critical factor in evaluating the portal quality. These responses show that the system of the portal provide users with a suitable and functional feature in terms of accessibility, navigability and response time. Information quality was ranked the third in the evaluation. Based on [19], well-organized information, and specialized notifications have advantages in increasing the users' satisfaction on information quality. Thus, the portal should have more information resources, the interactive features such as connection with social media and facilities to provide relevant information [20]. In contrast, users with low experienced group indicated attractiveness as the second critical factors. The decision was due to the visually pleasing interface of the portal which is fun to operate.

For the sub-criteria of service quality, responsiveness was found to have different values for both user groups. This indicates that users individually had different experience of responsiveness towards the portal. Apparently, for the sub-criterion of system quality, the lowest is navigability. Response time received the highest scores from high experienced group, and accessibility received highest scores from low experienced group. This shows that the developer manage to provide a good system in terms of loading time and good access. The reason for the navigability is probably due to the inefficient paths of UiTM student portal. The paths link references through pages that could lead to the lowest weight for the sub-criterion in system quality. The enjoyability which is attractiveness attribute had the lowest score for both user groups in this research. This finding shows that the manager and designers should highlight portal visual attractiveness to make the users feel more contented in using the portal [4]. As stated by [21], perceived playfulness is related with satisfaction and keeps the positive mood of the user to use the web portal [14].

Based on the findings, service quality, system quality and attractiveness criteria give a big impact on the study of the student portal quality. Service quality criteria which was ranked the first shows that users are more concerned about the improvement of service quality that will affect their

satisfaction level. When the expected quality of the service criteria is not achieved, users tend to report or complain any problem related to the accessibility of the portal. The users' responses reaffirm that service quality of the student portal is the most important criteria which should be given an utmost priority to ensure the optimum performance of the portal. In conclusion, it is obvious that service quality, system quality, information quality and attractiveness influence the quality of the portal. Therefore, it is necessary for UiTM Student Portal developer to address the quality requirements to meet the users' satisfaction [22]. This is to ensure that users would be able to get full benefits of the student portal service and the portal itself will be fully utilized. Future research might consider other criteria that influence the quality of student portal, together with different methodology.

REFERENCES

1. Thomas-Alvarez, N. and L. Mahdjoubi, *Testing the effectiveness of a web-based portal system for the building control sector.* Automation in Construction, 2013. **29**: p. 196-204. https://doi.org/10.1016/j.autcon.2012.02.018
2. Liu, C.-T., T.C. Du, and H.-H. Tsai, *A study of the service quality of general portals.* Information & Management, 2009. **46**(1): p. 52-56. https://doi.org/10.1016/j.im.2008.11.003
3. Rainer, R.K., Turban, E., Potter, R.E. and Cegielski, *Introduction to Information Systems: Enabling and Transforming Business*. 2010: John Wiley and Sons Inc., NJ.
4. Granić, A., I. Mitrović, and N. Marangunić, *Exploring the usability of web portals: A Croatian case study.* International Journal of Information Management, 2011. **31**(4): p. 339-349. https://doi.org/10.1016/j.ijinfomgt.2010.11.001
5. Cheng-Kui Huang, T. and C.-H. Huang, *An integrated decision model for evaluating educational web sites from the fuzzy subjective and objective perspectives.* Computers & Education, 2010. **55**(2): p. 616-629. https://doi.org/10.1016/j.compedu.2010.02.022
6. Nitasha Bansal, H.M., *Quality Modelling of Web Portal*, in *Proceedings published in International Journal of Computer Applications*. 2011.
7. Lin, H.-F., *An application of fuzzy AHP for evaluating course website quality.* Computers & Education, 2010. **54**(4): p. 877-888. https://doi.org/10.1016/j.compedu.2009.09.017
8. Cho, V., T.C.E. Cheng, and W.M.J. Lai, *The role of perceived user-interface design in continued usage intention of self-paced e-learning tools.* Computers & Education, 2009. **53**(2): p. 216-227. https://doi.org/10.1016/j.compedu.2009.01.014
9. Tzeng, G., C. Chiang, and C. Li, *Evaluating intertwined effects in e-learning programs: A novel hybrid MCDM model based on factor analysis and DEMATEL.* Expert Systems with Applications, 2007. **32**(4): p. 1028-1044. https://doi.org/10.1016/j.eswa.2006.02.004
10. N. Janaki Devi, R.V.K.K., M. Sandeep Kumar, *Image Enhancement based on Fuzzy Logic and Thresholding Techniques.* International Journal of Advanced Trends in Computer Science and Engineering, 2017. **3**(6): p. 102-106.
11. Direk Ounkaew, R.C., Janjira Payakpate, *An Application of MCDM on Dormitory Consideration.* International Journal of Advances in Computer Science and Technology (IJACST), 2014. **3**(11): p. 27-29.
12. Torfi, F., R.Z. Farahani, and Shabnam Rezapour, *Fuzzy AHP to determine the relative weights of evaluation criteria and Fuzzy TOPSIS to rank the alternatives.* Applied Soft Computing, 2010. **10**(2): p. 520-528. https://doi.org/10.1016/j.asoc.2009.08.021
13. Sun, C.-C., *A performance evaluation model by integrating fuzzy AHP and fuzzy TOPSIS methods.* Expert Systems with Applications, 2010. **37**(12): p. 7745-7754. https://doi.org/10.1016/j.eswa.2010.04.066
14. Hsieh, P.H., C.S. Huang, and D.C. Yen, *Assessing web services of emerging economies in an Eastern country — Taiwan's e-government.* Government Information Quarterly, 2013. **30**(3): p. 267-276. https://doi.org/10.1016/j.giq.2013.02.003
15. Chou, S.-W. and Y.-C. Chang, *The implementation factors that influence the ERP (enterprise resource planning) benefits.* Decision Support Systems, 2008. **46**(1): p. 149-157. https://doi.org/10.1016/j.dss.2008.06.003
16. Monim, S.A., et al., *Exploring students' satisfaction with universities' portals in developing countries: A cultural perspective.* International Journal of Information and Learning Technology, 2015. **32**(2): p. 82-93. https://doi.org/10.1108/IJILT-12-2012-0042
17. Adeyinka, T., *Undergraduate Students' Satisfaction with the Use of Web Portals*. Vol. Volume 2. 2012. 56-73. https://doi.org/10.4018/jwp.2012040104
18. Mohamad, N.b.M., *Measuring campus portal effectiveness and the contributing factors.* Campus-Wide Information Systems, 2007. **24**(5): p. 342-354. https://doi.org/10.1108/10650740710835760
19. Hu, C.-P., Y. Hu, and W.-W. Yan, *An empirical study of factors influencing user perception of university digital libraries in China.* Library & Information Science Research, 2014. **36**(3): p. 225-233. https://doi.org/10.1016/j.lisr.2013.10.008
20. Latysheva, E.V., L.V. Karlova, and A.S. Koryakina, *Internet Communication and Transformation of University Information Space.* Procedia - Social and Behavioral Sciences, 2015. **166**: p. 566-571. https://doi.org/10.1016/j.sbspro.2014.12.574
21. Lin, C.S., S. Wu, and R.J. Tsai, *Integrating perceived playfulness into expectation-confirmation*

model for web portal context. Information & Management, 2005. **42**(5): p. 683-693. https://doi.org/10.1016/j.im.2004.04.003

22. Mohamad, N.M., J. Adnan, and A.M. Sobariah, *Evaluating academic library portal effectiveness: A Malaysian case study.* Library Review, 2010. **59**(3): p. 198-212. https://doi.org/10.1108/00242531011031188