J. of Family and Society Research 3 (1), June 2024, pp. 37 – 47

JFSR

Concept Maps for Elasticities of Demand and Supply: Online Resources for Economics Students

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Abstract

Online resources are gaining momentum across the education setting due to technological advancement and the recent COVID-19 pandemic. This has resulted in the use of different tools and strategies in providing educational resources for today's technology-driven learners. Technology-based learning resources tend to capture learners' interest in this digital age. Therefore, this study provides concept maps as online resources for Economics students.A concept map is a knowledge representation in the form of a graph comprised of boxes connected with labeled arcs showing the relationships among concepts and ideas. The study was an exploratory survey study with two objectives constructing online concept maps and determining students' views on the constructed maps. The area of the study was Nsukka Local Government Area. The population was 2,389 SS2 Students from the 32 secondary schools in Nsukka LGA. The sample size was 120 SS2 Economics students using a simple random sampling technique. The instrument for data collection was a rating scale titled 'Rating Scale on Concept Maps for Elasticities of Demand and Supply (RSCMEDS)'.Mean scores and standard deviation were used for data analysis. Findings showed that students' views on the constructed online maps were positive. The students were of the view that the online resources suit their digital need (mean = 3.09) and that the resources are easy to read and understand (mean = 2.90). The researcher believes that the online concept maps resources will serve as better alternative to traditional lecture method used mainly in schools. And thus, they will help to promote students' interest and achievement in learning the mapped contents in Economics.

Keywords: Online resource, Economics, Concept maps, Elasticity of Demand and Supply.

Introduction

Economics is concerned with the study of what is to be produced, who gets what is produced, how much, and how the production will be carried out. It is all about making choices in the face of numerous alternatives. Hall (2013) defined Economics as the study of how individuals, firms, and whole societies identify their most important needs and allocate and manage scarce resources in such a way that satisfies as many needs as possible. Economics is, therefore, seen as a subject or course that studies human actions in relation to scarce resources and unlimited wants. Economics is a subject that enables students to make smart choices and proper resource management in the face of scarcity. Accordingly, Mohammed and Pitan (2022) noted that with the knowledge of Economics, graduates should have acquired relevant functional economic skills needed for poverty eradication, job creation, and wealth generation.

Economics helps one to become a useful citizen. Yusuf, (2012) asserted that understanding Economics is a prerequisite for good citizenship which involves the ability to make rational decisions on

important economic issues with a good basis for doing so. Exposing students to an Economics curriculum will make them better equipped with the right knowledge, skills, and attitudes that will keep them focused on maximizing their economic potential and thus stay off unethical practices. Accordingly, Ojo and Nkoyane (2016) noted that the purpose of economics is to create future responsible citizens, effective decision-makers, and voters for change. Therefore, the level of Economics knowledge of a student will determine their ability to solve economic problems and make rational decisions concerning society.

However, there seems to be poor achievement of students in the subject despite its importance. West African Examination Council (WAEC) Chief Examiner's Reports from 2017 through 2019 revealed that students' achievement in Economics has been consistently poor (WAEC, 2017, 2018 & 2019). In 2023, the Chief Examiner reported that quite a good number of candidates showed great deficiency in the interpretation of graphical representations of economic concepts which resulted in poor performance in questions where such ability was required.

From the foregoing, it is only wise then to provide resources that will cater for students' enhanced understanding of Economics concepts and topics with graphical representations and interpretations. Among such concepts and topics with graphical representations are elasticity of demand and elasticity of supply. The elasticity of demand is the degree of responsiveness of demand for a commodity to changes in the price of the commodity, another commodity or income. On the other hand, the elasticity of supply is the degree of responsiveness of the supply of a commodity to changes in price. These two topics in Economics have lots of graphical connotations, illustrations, and representations. Based on this, the researcher believes that the graphical nature of concept maps will be a good match for their representations in a technological or online environment to capture the interest of today's technology-hungry and driven learners. Therefore, the paper provides concept maps on elasticities of demand and supply as online resources for Economics students.

Technology has changed the whole pattern of human life. One of the greatest contributions of technology is the development of computers and their use in all walks of life. Using computers in education is now gaining momentum. Technology seems to be driving and redirecting education and its mode of delivery. Recognizing the place of technology-enhanced learning, the Federal Government of Nigeria (FGN) (2013) in the National Policy on Education, section 5 noted that for effective functioning in the modern world, there is a need to integrate information and communication technology (ICT) into education in Nigeria. The need for computers in education has increased following the challenges brought by the COVID-19 pandemic. Accordingly, Oltean (2021) noted that the single solution to continue the educational activity after the suspension of onsite activities due to COVID-19 was represented by the transition towards the use of online educational delivery and resources. In this study, therefore, online resources are the presentation of curriculum contents for students through technologies made available on the internet.

Online resource is the availability of learning materials for students through the internet. With online resources, students are provided with the website(s) they need to visit to get a given task done. Khan et al. (2012) referred to online resources as a hypermedia-based instructional programme that utilizes the attributes and resources of the World Wide Web to create a meaningful

learning environment where learning is fostered and supported. Online resources describe any form of material delivered using digital technology that incorporates visual graphics, text, animations, videos, and audio (Basar et al., 2021). Online resources promote access to information for a wide range of students irrespective of location. Students across the globe can easily access the information.

The online resources in the study are made available with concept maps. A concept map is a visual representation of knowledge by showing the relationship(s) between concepts and ideas using computer software. By drawing a concept map of a material, say a chapter in a textbook, a learner can identify the key concepts and show the relationships between them. This helps him/her to understand more clearly the meaning of the material. Concept map is a way of representing knowledge as a set of concepts and the relationships between the concepts in graphical formats (Canas et al., 2017). Safayeni et al. (2013) defined concept map as a knowledge representation tool in the form of a graph comprised of boxes connected with labeled arcs. Concepts are located inside the boxes or circles, and relationships between different concepts are specified on each arc creating a proposition. A significant variation of a proposition is a crosslink, which shows the relationships between ideas in different segments of the map; and propositions (node – link – node triads) are a unique feature of concept maps, compared to other similar graphs (Safayeni et al., 2013).In concept maps, abstract concepts are presented in a concrete way; the relationship between concepts and facts are clarified, and new information are connected to prior knowledge in order to make meaningful learning.

A concept map provides a common denominator between visuals and thought and between the mind and the pictures (Mashhadi et al., 2021). Concept map has been increasingly promoted to facilitate thinking in complex situations as it represents cognitive structures and processes in visual formats that amplify, extend, and enhance human cognitive functions and engage learners as they represent and reflect on what they know (Wang et al., 2018).

Constructing a concept map involves several steps. Sundar (2022) has six steps for constructing concept maps. For Sundar, the first step in constructing a concept map is the focusing stage which deals with selecting a topic or theme. This is followed by the brainstorming stage which deals with getting informed on the topic through reading materials to know the selected topic/theme and associated concepts or ideas and making a list of these ideas or concepts. The third step in Sundar's steps for constructing a concept map is the organizing stage dealing with the placement of similar or more related ideas/concepts close to each other. The fourth stage is the layout stage which entails the use of lines and arrows to connect the concepts and show the directional relationships among the concepts. The linking stage which is the fifth step is on labeling the arrows using linking words and phrases to link them to the concepts. The final step for Sundar is the revisiting stage which is on removing any redundant concepts or ideas if they lack any relationship or placing them accordingly if they still fit in the map and adding any additional concepts that fit in the map and making cross links (Sundar, 2022).

These steps/stages align with the guidelines on constructing concept maps given by Johnston (2013:3) as follows:

1. Select and read a chapter in a textbook or a set of lecture notes on a particular topic, highlighting the important points and ideas when going along.

2. After reading and highlighting, identify the key concepts necessary for understanding the topic and make a list of their names.
3. Decide which concept (or concepts - there may be more than one) is the most important or most inclusive idea and make a list with this concept at the top. Find the next most general concept and write it next. Proceed to rank or cluster the remainder of the concepts from most inclusive or most general to least inclusive or most specific.
4. Begin constructing a concept map by placing the name of the broadest, most inclusive concept(s) at the top of a piece of paper. Work down, adding more specific concepts. Sometimes these may be located alongside each other like brands of detergent on a supermarket shelf; sometimes it is most sensible to have them in descending order, one above the other. Enclose each term in a box or circle.
5. Join the concepts with lines and label the lines with linking words that show meaningful connections between the concepts. As a first step, formulate the word or words that accurately describes, according to the text reading, the relationship between the super-ordinate concept and the subordinate concept related to it. These are the linking words. The learner (mapper) should try to be economical in formulating these links. Linking concepts is the most important aspect of concept mapping. Here are a few examples of linking words used to describe relationships: composed of, includes, depends on, is influenced by, causes, and is affected by.
6. Finish mapping in all the concepts in the list (see Step 1 above). Continue to make the map grow by relating additional concepts from the list to concepts already on the map. Continue with the more 'inclusive' terms first, working down to the most specific terms until all the concepts are mapped in.
7. Now study the map to see if there are any other relevant relationships that should be illustrated between terms on the map. Such relationships, if they exist, may take the form of cross-links. Cross-links are relationships that exist between two concepts in different vertical segments of the concept map. Cross-links help to integrate a concept map into a cohesive whole. Cross-links can be constructed at any point in the mapping process. In fact, the learner will often identify cross-links when only some of the terms have been mapped. Such cross-links may be forgotten if not mapped in at that point.
8. When the concepts are linked together to form a cause-effect relationship an arrow is used to show the direction of the relationship. Not all links need to be one-way. Look for examples of two-way interdependency (sometimes it might be indirect, that is, via another concept or concept - and is best shown by a series of cross-links).

These steps for constructing a concept map can be summarized in four simple steps. They are the selection of a topic; generation of related concepts/ideas; linking concepts/ideas with arrows and the linking words/phrases to show the relationships, and revision. Looking at the steps for constructing a concept map, it can easily be observed that when mapping concepts, the mapper is bound to make some alterations, modifications mistakes and have them corrected. Making these corrections could be very frustrating and cumbersome when concept maps are done manually. A manual concept map is a concept map constructed using pen and paper. Pen and paper or manual concept maps are difficult to revise (Chang et al., 2016).Constructing concept

maps manually could be messy and wasteful because one keeps erasing and/or turning pages of physical papers to accommodate changes in the maps. This then necessitated the construction of concept maps in a computer environment for easy revisions leading to the online concept maps.

Objective of the Study

The main objective of this study was to provide online concept maps on elasticity of demand and elasticity of supply contents in the Economics curriculum. The specific objectives of this study were:

1. To provide concept maps as online resources for Economics students.
2. Find out students' views on the online concept map resources.

Methodology

Study design: This study was an exploratory survey study. The study constructed online maps and sought the views of some learners on the maps. The concept maps are constructed with a Cmap-free concept mapping tool from the Florida Institute for Human and Machine Cognition (IHMC). There are three concept maps for the elasticity of demand due to the robustness of the topic while the elasticity of supply has one map. The maps have embedded annotations and attachments for tables, graphs calculations, and other illustrations.

Population for the Study: The population was 2,389 Senior Secondary School Two Students from the 32 secondary schools in Nsukka LGA.

Sample Selection: The sample size was 120 SS2 Economics students. Using a simple random sampling technique, six schools were sampled from the 32 schools in the LGA. Twenty SS2 Economics students were then sampled from each of the six sampled schools using a simple random sampling technique. This gave a total sample size of 120 Economics students.

Instrument for Data Collection: The instrument for data collection was a rating scale titled 'Rating Scale on Concept Maps for Elasticities of Demand and Supply (RSCMEDS)'. The rating scale has eight items with four response options: Strongly Agree (4 points), Agree (3 Points), Disagree (2 points), and Strongly Disagree (1 point).

Validation and Reliability Test: Both the constructed maps and the RSCMEDS were face-validated by seven experts. Two of the experts are educational technologists, three Economics Educationists, one Measurement and Evaluation expert, and one Software and Multimedia Development expert, all from the University of Nigeria, Nsukka. The RSCMEDS was subjected to a reliability test using Cronbach Alpha reliability estimate using data obtained from twentyEconomicsSS2 students outside the sampled schools. RSCMEDS yielded a reliability index of 0.79which made the instrument reliable for the study due to the high index.

***Data Collection Method*:** The students were exposed to the constructed online concept maps. After this, their views on the online concept maps were sampled using the RSCMEDS. Mean scores and standard deviation were used for data analysis.

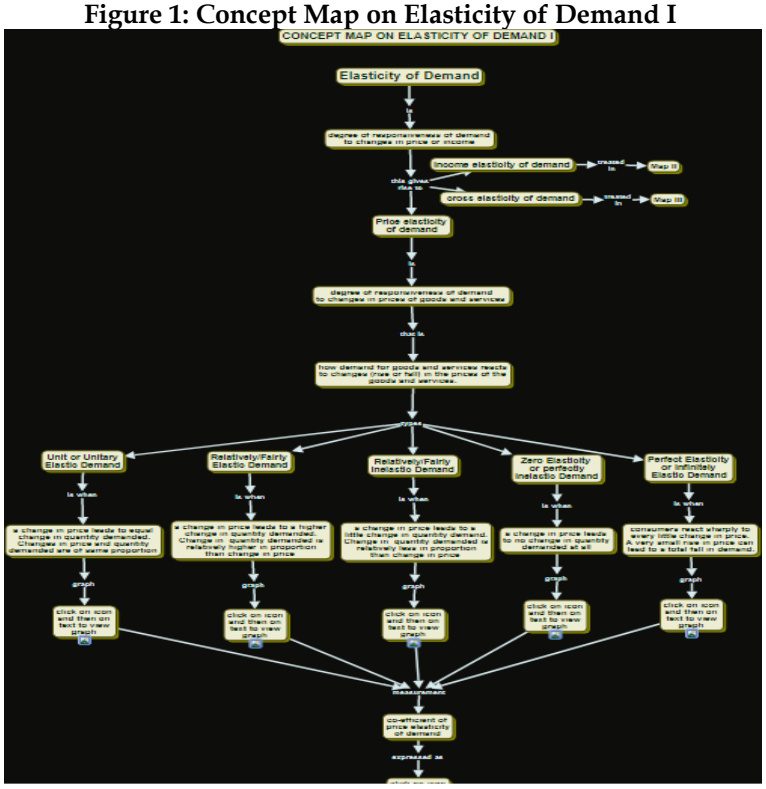
Results

Concept maps as online resources for Economics students

The constructed concept maps online resources are presented below in Figures 1-4 with brief descriptions and their online addresses. Figure 1 shows the screenshot of the concept map on elasticity of demand I. The map contains the definition of elasticity of demand, giving rise to price, income, and cross elasticity of demand. It then covers the meaning of price elasticity of demand and its

types and graphs. The online map further contains the computation of the co-efficient of price elasticity of demand with examples.

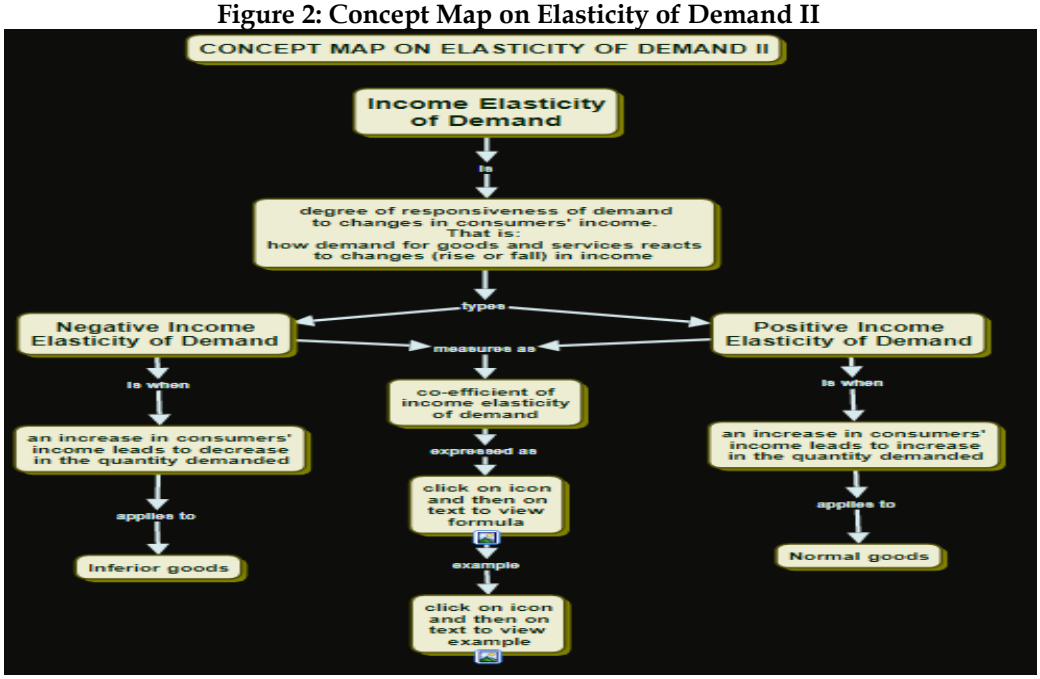
Figure 1: Concept Map on Elasticity of Demand I



Online Address: https://cmapscloud.ihmc.us/viewer/cmap/1Z21X1HQR-FQQM45-DTVJWY
Note: This is just a screenshot and, hence may not be clear and does not have all the information as contained in the online map.

Figure 2 below shows the screenshot of the concept map on elasticity of demand II which contains income elasticity of demand. It covers the meaning of income elasticity of demand and its types. The online map further contains the computation/calculation of co-efficient of income elasticity of demand with examples.

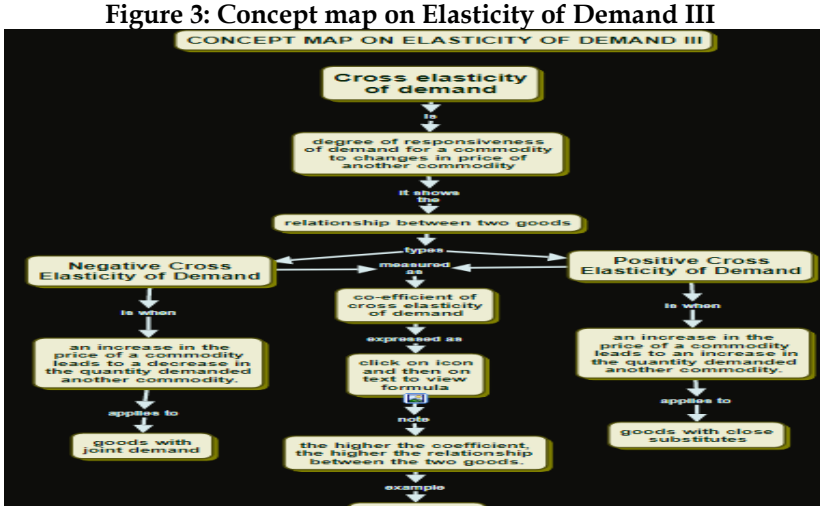
Figure 2: Concept Map on Elasticity of Demand II



Online Address: https://cmapscloud.ihmc.us/viewer/cmap/1Z21XVSXG-N77T48-DTYKFK
Note: This is just a screenshot and, hence may not be clear and does not have all the information as contained in the online map.

Figure 3 below shows the screenshot of the concept map on elasticity of demand III containing cross elasticity of demand. It covers the meaning of cross elasticity of demand and its types. The online map further contains the computation/calculation of co-efficient of cross elasticity of demand with examples.

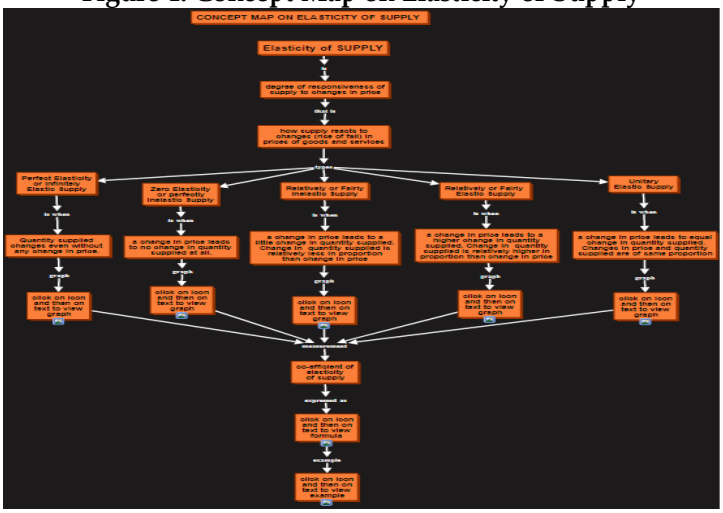
Figure 3: Concept map on Elasticity of Demand III



Online Address: https://cmapscloud.ihmc.us/viewer/cmap/1Z21XWGF9-23S0F97-DTYMB5
Note: This is just a screenshot and, hence may not be clear and does not have all the information as contained in the online map.

Figure 4 below is the screenshot of the concept map on elasticity of supply. The map contains the definition of elasticity of supply. It also covers the types of elasticity of supply with their corresponding graphs. The online map further contains the computation/calculation of co-efficient of elasticity of supply with examples.

Figure 4: Concept Map on Elasticity of Supply



Online Address: https://cmapscloud.ihmc.us/viewer/cmap/1YYVF9RR3-29CW9MR-3M44C7

Note: This is just a screenshot and, hence may not be clear and does not have all the information as contained in the online map.

Student-Users' views on the online concept maps resources

Table 1 below showed students' views on the online concept maps resources. The data showed that the mean scores of all the items are all above the 2.50 benchmark and the small standard deviations show that the scores are not widely dispersed but close. The grand mean is also above the 2.50 benchmark. This indicates that students' views on the constructed online concept maps are positive.

Top on students' responses are that: the calculations in the online maps are presented step by step (mean = 3.27); the graphs in the maps are well explained (mean = 3.25); examples used in the maps are relevant (mean = 3.22); the online resources suit their digital need (mean = 3.09) and that the resources are useful to their Economics learning (mean = 2.96).

Table 1: Student-users' Views on the Online Concept Maps Resources

Item Statement	Mean	Standard deviation	Decision
The online resources suit my digital need.	3.09	0.95	Accepted
The resources are easy to read and understand.	2.90	1.13	Accepted
They are useful to my Economics learning.	2.96	1.29	Accepted
My knowledge of elasticities of demand and supply is enhanced through the resources.	2.82	0.82	Accepted
The graphs in the maps are well explained.	3.25	0.78	Accepted
The calculations in the maps are presented step by step.	3.27	0.82	Accepted
The calculations in the maps are easy to follow.	2.96	0.63	Accepted
The examples used are relevant.	3.22	0.80	Accepted
Grand Mean	**3.06**	**0.31**	**Accepted**

Discussion

This study constructed, documented and validated concept maps for elasticities of demand and supply as online resources for Economics students. Students' views on the online resources were highly positive. Students were of the view that the online resources suit their digital need, are easy to read and understand, useful to their Economics learning, and enhance their knowledge of elasticities of demand and supply. They also believed that the graphs in online concept maps were well explained, the calculations were presented step by step and were easy to follow, and that the examples used are relevant.

The findings made in this study could be explained by the fact that today's learners are technologically driven. Any introduction of technology in their learning process seems to lighten up their mood and boost interest. This is in support of the position of Kutlu and Menzi (2013) that online delivery attracts the interest and provides the needs of the learner. With the current crop of learners in this digital era, having online instruction makes the teaching and learning process readily acceptable by students. Online activities seem to be an inseparable part of the daily lives of the digital learners. The online concepts maps in this study are a way of giving students the opportunity to learn with technology, hence, their positive views on the online resources. Accordingly, Uygur (2019) observed that the digital learners get motivated more easily in the lesson when the methods containing technology are used in their learning environment. In line with the findings of this study, Vitoria et al. (2018) in a study on students' perceptions on the implementation of e-learning revealed that all students were of the belief that the e-learning module they took was useful, stating that they understood information given. Furthermore, Faloye and Obateru (2021) reported that utilizing virtual instructional tools is pedagogically efficient as they serve as a boost for students' learning outcomes.

Conclusion

The researcher concludes that the provision of online resources is useful and suitable for Economics students and believes that if integrated into the teaching and learning process, these online concept maps will help increase students' interest in learning the mapped topics in Economics and subsequently enhance their achievement in those areas. This will also help when there is a need for reduced physical contact among teachers and learners as was the case during COVID 19 pandemic.

Recommendations

Based on the findings and discussions so far, the researcher recommends the following:

1. Economics teachers should use the online concept maps in their teaching of the mapped topics.
2. Ministry of Education through the relevant bodies should include the links for the provided resources in Economics curriculum.
3. Economics teachers and related curriculum developers should construct and provide online concept maps in other contents in Economics.

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