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Preface

We would like to present, with great pleasure, the inaugural volume-5, Issue-1, January 2019, of a scholarly journal, *International Journal of Engineering Research & Science*. This journal is part of the AD Publications series *in the field of Engineering, Mathematics, Physics, Chemistry and science Research Development*, and is devoted to the gamut of Engineering and Science issues, from theoretical aspects to application-dependent studies and the validation of emerging technologies.

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Each article in this issue provides an example of a concrete industrial application or a case study of the presented methodology to amplify the impact of the contribution. We are very thankful to everybody within that community who supported the idea of creating a new Research with IJOER. We are certain that this issue will be followed by many others, reporting new developments in the Engineering and Science field. This issue would not have been possible without the great support of the Reviewer, Editorial Board members and also with our Advisory Board Members, and we would like to express our sincere thanks to all of them. We would also like to express our gratitude to the editorial staff of AD Publications, who supported us at every stage of the project. It is our hope that this fine collection of articles will be a valuable resource for *IJOER* readers and will stimulate further research into the vibrant area of Engineering and Science Research.

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Primary Investigation of Small-medium cities' Property Management Charging Difficulty

Ling Zhang

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***Abstract*—** A*s property management fee is the blood guaranteeing normal operation of property management activities, as well as a big issue involving the immediate interests of owners and real estate users, it receives great concern by owners and real estate management companies. In addition, it is a common phenomenon in the industry that property management fee collection is difficult. Directly related to the survival and development of real estate industry, it will also influence residential owners' comfortable housing and stability of residential area construction.*

***Keywords*— property management, charging difficulty, residential owner, comfortable housing.**

I. INTRODUCTION

Modern property management and services can bring favorable social, economic and environmental benefits to the housing estate. Property service companies provide paid services to owners and they should be charged accordingly. However, in actual operations, due to various reasons, some companies collect insufficient fees, which have affected their normal business and operation. Many companies have failed to pay or even have serious losses. Meanwhile, property management charging issue will soon become a one of the "bottleneck" restricting the development property management industry.

II. MAIN REASONS OF PROPERTY MANAGEMENT CHARGING DIFFICULTY

2.1 Property developer

2.1.1 Advertising commitments are hard to be fulfilled

With the improvement of people's living standard in small-medium cities, owners are setting higher requirements for property management. To meet consumers' demands and guarantee real estate marketing, developers usually take exaggerated advertising measures and make unrealistic promises. But owners after checking in and living usually find far from the truth. Property companies cannot fulfill the commitments made by them, so some owners express their dissatisfaction by not paying property management fee.

2.1.2 Hardware facilities are defective

Some of the developers' building engineering problem have directly led to the inadequacy of property management, and caused non-fulfillment of property services. For example, monitoring system engineering cannot be put into use due to quality problems, which seriously affects the property company's management of the housing estate security. Project phased development results in the phenomena of check-in and construction simultaneously, so that property companies cannot effectively manage the housing estate, making the pre-planned green space fail to meet the standard and resulting in the malfunction of parking lots. Construction units conduct construction not in accordance with the design requirements, lay out the sewage pipelines of different depths, which often lead to serious blockages. Therefore, owners sometimes feel dissatisfied or even have antagonistic emotions when being charged service fees.

2.2 Property

2.2.1 Service quality problem

Many property management companies anxious to realize corporate profits neglect to improve their own service quality. For example, the quality of the property staff is poor, service awareness is weak, and service skill level is low, which finally result in three main service quality problems, "inadequate service", "delayed maintenance" and "irregular charging". It is also the focus of conflicts between owners and property companies. In many small and medium-sized cities, the phenomenon that property management companies emphasize charging but ignore management, overcharge and quality does not conform to the price can be found everywhere, which has made property owners feel strongly dissatisfied.

2.2.2 There is no financial transparency

The management fees collected by property management companies and their use condition should be regularly announced to the owners and supervised by the owners. Periodically publicizing the income and expenditure of property management services and enhancing the transparency of the income and expenditure of property management services are an important manifestation forms of respecting the right to know of the owners. However, some companies lack transparency in their financial operations without willing to publicize the income and expenses of management fees to owners. The owners will feel psychologically imbalanced when paying property fees but seeing no expenditures from property companies, thus they will refuse to pay property management fee.

2.3 Poor communication ability

Property Management Company as a producer of public goods cannot effectively promote their products without a series of scientific and effective promotion means. It is of course important for property management companies to display themselves in market competition. However, more important thing in front of developers is how to display ourselves after taking over the property and how to publicize ourselves so that our public product, service, can earn owners' recognition . However, one of the reason why owners refuse to pay property management fee is because of their incomprehension of the staff cost and the cleaning and maintenance of the public areas.

There are a lot of types of owners who refuse to pay property management fee, so multiple channels and means are required to deal with charging difficulty.

2.4 Owner

2.4.1 There are some misunderstandings of owners' consumption concept

Some property owners with no awareness that property service is a kind of consumer behavior regard property management companies as housekeepers taking care of everything in the housing estate. So they attribute leakage and noise caused by neighbors to the property management companies' poor service quality, which is also used as an excuse for them to pay no fees. Zhenghong Property Management Co., Ltd. is an example. Some specific owner asked the company for pipeline dredging when sewer is blocked and ask for facility maintenance when damaged. However, the owner refused to be charged as the owner believes that the property fee has been paid and they should not pay again. Therefore, there will be a certain loss of property material costs and labor costs.

2.4.2 Owners' service satisfaction is lack

Due to no uniform regulations and inspection standards issued by the government for property management services, there are no uniform requirements on how much property management fees are paid, what kind of property service standards should be reached, and how to achieve quality-price parity, which result in a large gap in understanding of property service standards between the owners and property management companies. Property management companies can only provide relevant property service based on the interests of both parties according to the property management charging situation.

However, in actual management, problems such as inadequate service, untimely maintenance and irregular charging prevail among many property management companies, which directly affect the public image of the entire property management industry among ordinary people. This also makes owners complain the property management company. Therefore, they refuse to pay property management fees.

2.4.3 Owners are not clear with the management scope

As owners are not professional property management staffs, they cannot fully understand the property management as a systematic paid service behavior without in-depth cognition of property management. At present, the owners generally believe that the main work of the property management company includes clean-keeping, security and a forestation. At the same time, it is also believed that the property management company shall be responsible for all the quality problems of the housing. Therefore, once there is a quality problem in the house, it is used as an excuse for them to refuse to pay property management fees, to pay less, or pay fees overdue. They do not know that these problems were caused by the developer or their own improper decoration. This is not the responsibility of the property management company and this does not belong to the responsibility range of the property management company.

III. EFFECTIVE MEASURES TO SOLVE PROPERTY MANAGEMENT CHARGING DIFFICULTY

Property management charging difficulty is the most prevalent problem in this industry. According to statistics, very few housing estates can reach a 100% of property management charging rate. Therefore, it is very important to research relevant measures to solve the charging difficulty.

3.1 Improve citizens' property management consumption awareness

To establish a good and harmonious relationship between the owner and the property management company, solve the property management charging difficulty, the competent authorities, the media and the real estate shall strengthen the publicity of property management knowledge among owners. Property service enterprises, government sectors and industry associations should widely propaganda, enhance the social cognition degree of the property industry among owners and customers from the aspects of industry laws and legal knowledge by adopting a variety of methods by virtue of various media so as to help owners to understand the advantages and necessity of implementing market-oriented, professional, and socialized property management, and understand the importance of property management in maintaining and increasing the value of the property and improving the quality of life, for the purpose of establishing residents' correct consumption concept of "pay for services".

3.2 Change the charging attitude and means

In the past, property charging personnel used to collecting fees at the home of owners regularly, which made the charging timeliness rate and collection rate not high. With a large number of charging points and a wide range of fees, charging personnel with high labor intensity will inevitably have indifferent, cold, and tough attitude, which could hardly achieve smooth communication with owners and result in the owners' dissatisfaction to the property management company and their unwillingness to pay property fees. For this problem, the property management company should take some measures based on the actual situation, change the working methods and charging attitudes, carry out electronic payment, and mobilize the majority of the owners to accept this scientific, convenient and electronic payment method of property services that is in line with the modernization of the city.

3.3 Strengthen Property Company's self-construction

To improve the owner's satisfaction, the property management company should find reasons from themselves. Property management companies should strengthen their own construction, establish correct service concepts, work hard to improve service quality, adjust internal mechanisms, strengthen management, establish rules and regulations, formulate service standards, standardize codes of conduct, and continuously improve service quality so as to satisfy owners' demands and receive their recognition and satisfaction.

3.4 Perfect laws and regulations

Public maintenance fund utilization methods, regulations on the management of elevator charges, administrative provisions charging water and electricity to end-users, and standards for charging commercial properties should be issued urgently. In addition, at present, some laws and regulations have been established from the perspective of the property management industry, but regulatory documents from the consumer's aspect are not enough. Therefore, relevant law and regulation system should be established as soon as possible to clarify the responsibilities, rights and interests of housing consumers during the process of housing consumption.

The most basic characteristic of a market economy is to act according to contracts. Real estate service companies must operate in accordance with current laws and regulations, which is the basic and most important countermeasure to solve current charging difficulty. Therefore, no matter what project a company takes over, it must sign the contract with the power of attorney in accordance with the relevant laws and policies. In addition, the contract text should clarify the relevant parties' responsibilities, rights, and interests. The type, standard, time, payment requirements, expense range and delinquency fees for service charges, liability for breach of contract for non-payment, and solutions shall be specified at length. This is the basis for carrying out entrusting work and charging work. The property management fee should be paid by each owner who enjoy property service. If property owner fails to fulfill the payment, property service companies or other agencies should be legally authorized to take necessary measures to solve the problem.

IV. CONCLUSION

Solving property management charging difficulty can help to normally carry out property management work and improve urban civilization level. With deepening reform of Chinese housing system and further prosperity of market economy, strengthening to solve property management charging difficulty and promoting property management to develop in a healthy and scientific way has realistic significance.

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The Implementation and Countermeasures of Green Property Management in Sanmenxia City under the Background of Urbanization

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Abstract— *Promoting the concept of green property management is based on the construction of Green House under the background of urbanization and the owner's demand for green consumption. Taking Sanmenxia as an example, the implementation of green properties reflects people's requirements for living environment. Meanwhile, property management has transformed from a one-way management model to a comprehensive management efficiency model. The model of property management is also developing towards green property management.*

Keywords— Green Property Management; Garbage Classification; Urbanization Problem Presentation.

I. BACKGROUND

Sanmenxia has become an important national metal and energy development and production base since the reform and opening up, especially known by the Yellow (gold), White (bauxite)and Black (coal)" as a mature and resource-based city identified by the State Council's Resource-based Cities Sustainable Development Plan (2013-2020).

However, a series of figures is getting Sanmenxia people's attention. Industry accounts for 67% of the total economic output. Resource-based industries account for 70% of the total industrial output. The price of resource products suddenly dropped under the international financial crisis in 2008. 70% of the resource-based enterprises in the industry suffered large losses. A large number of small and medium-sized enterprises were in production suspension and semi-production suspension. The growth rate of Sanmenxia's GDP from the top three in the province suddenly dropped to the bottom of the province. Sanmenxia people realized that the resource-based industrial city that once prides itself on "seeing a train by the chimneys" will face transformation and development. What we are facing are pollution and energy depletion. Therefore, we should use its own advantages to develop green industries. Then where should be managed? Should an industry that involves the lives of the people be transformed? The answer is yes. It should also be developed from property management to green property management.

II. RESEARCH DESIGN AND RESEARCH PROCESS

2.1 Questionnaire design

In order to fully understand the development prospects of Sanmenxia City's green property management and make the survey with a certain degree of accuracy, we will make a reasonable investigation of the understanding and prospect of green property management by residents of Sanmenxia City.

2.2 Sample selection

We selected Sanmenxia City Wanda Plaza as the survey site. A total of 100 questionnaires were retrieved and 100 useful questionnaires were received. The survey involves residents' understanding of the green property management and prospects.

2.3 Site selection

People have different understanding of the green property management. Wanda Plaza is the place with the most people in Sanmenxia City. The age, sex, and occupation meet the conditions for the surveyed people. Therefore, Wanda Plaza is the best place for investigation.

2.4 A Brief Introduction to the Survey Site

The Sanmenxia Wanda Plaza project is a large-scale urban complex integrating international supermarket with indoor and outdoor commercial pedestrian streets, movie cities, advanced shopping, restaurants, culture, and entertainment. It has a planned land area of 67,500 square meters and a total construction area of 110,700 square meters. It contains 700 ground

parking spaces, 4 large commercial design floors, 8 primary and secondary stores, 181 brands, 60,000 square meters of indoor street and 14,700 square meters of outdoor street. It will directly stimulate the economic growth of Sanmenxia City and the surrounding areas. It creates more than 4,500 new jobs, stimulates local and neighboring economies and market consumption.

2.5 Definition of green property management

Green property management emphasizes people-oriented. It is committed to providing quality services for the owners. It is a new type of property management that performs the concept of sustainable development. It considers the relationship between property management and environmental protection comprehensively for achieving a win-win situation between green property management and the construction of green communities. Green property management has been always improving its property management philosophy. It attempts to reduce environmental pollution, save energy resources and maintain a healthy and comfortable residential environment.

Compared with traditional properties, green properties in property development should have the following connotations: First, "Green" is a humanistic concept. The pursuit of green reflects the transformation of property consumption from the pursuit of quantity to quality. It embodies a cultural quality and moral accomplishment. It is a healthy concept of property consumption. This is the tranquility after the impetuousness of throwing away the eagerness for quick success and instant benefits. It is the closeness of nature that human beings feel after being punished for disregard for nature. It reflects people's respect for nature.

2.6 Analysis on the Present Situation of Property Management in Sanmenxia City

With the rapid development of property, problems in the property service industry in Sanmenxia gradually emerged. For example, property management supervision is unsound. There are many problems in the cleanliness and greening of property services. Problems like serious waste of water and electricity, improper equipment management, environmental pollution have arisen. The Riverside Garden District which was reported in the recent news is one of them. The property management was performed well for the first two years of the establishment of the Riverside Garden District. However, in recent years, the property management of the Riverside Garden has been getting worse. There are many vehicles occupy the green belt. The vehicles have been parked too much to cause traffic hazards. The underground parking lot has not been used so far. The service attitude of administer is poor and the collection of property fees has not been disclosed. As far as we know, such problems occur in most districts. This reflects that the property management is not performed well and the development of green property management is necessary.

2.7 The Implementation Process of Green Property Management Under the Background of Urbanization

2.7.1 The Launch of Green Property Management

The completion of a large number of properties has a negative impact on resource consumption. The building occupies a large amount of land resources and natural spaces. The extensive and traditional production processes of the construction industry has a negative impact on the natural state and air quality. They produce a large amount of waste. According to the survey, the pollution caused by building materials production and construction activities in China accounts for about 34% of all pollution, which has a great negative impact on the environment. The environmental awareness of the entire society has been improved. People not only pay attention to the quality of construction, but also pay attention to the environment of the community. They not only focus on structural safety, but also focus on indoor air quality. They not only concerned about the strong and durable materials and low prices, but also concerned about the impact of material consumption on the environment and energy. The "green" concept has become a new selling point in the current real property market. The concept of environmentally friendly, eco-friendly green houses or green residential areas has been frequently launched. New concepts such as green landscape, green decoration and green energy, and matching green properties have emerged. Building green properties and healthy homes are becoming the goals pursued by more and more developers and architects. It reflects the expectations of developers and consumers on the new property management model. It also reflects the new trend of property consumption demand and the "optimized" requirements for real estate market development in the 21st century.

2.7.2 The Promotion of Green Property Management

We must adhere to the principle of "people-oriented and owner-oriented". In the maintenance and construction of the community, we should integrate humanism and human factors through the implementation of humanized management and green property management. Firstly, we must pay attention to the needs of owners at different levels and safeguard their vital interests. We must regard employees as the foundation for prosperity of enterprises and concern their work, life, learning and progress. Secondly, we should regard all the owners as members of a large family and send care to every household. Thirdly,

we must shape the community spirit of modern civilization and create a harmonious environment where the owners live and work in peace and community is thriving.

Overall green awareness. Building and designing more green buildings during the planning and construction phase. Green building has become the main trend of the international mainstream construction industry and a global common desire and trend. We must design more green buildings that can make full use of natural environment resources, and use natural or environmentally friendly building materials and reusable materials. However, we must not undermine the dynamic balance of nature. We should choose green building materials and decoration materials according to experience and relevant national standards. The concept of green property management is promoted in accordance with the principles of a harmonious society at the stage of property management implementation. We can hold regular activities such as green consumption and environmental education for communities and enterprises.

III. SUGGESTIONS AND COUNTERMEASURES

3.1 Promoting Green Property Management Concept

One of the characteristics of green property management is people-oriented. Therefore, we must embody humanism, take owners as the center and implement humanized management in the process of management. Property management companies should expand the focus of property services. They should really care about the needs of the villagers and safeguard their vital interests. Property management should not only do a good job of "security,""cleaning,""greening" and "warranty." It should also actively contact with rural residents. Meanwhile, we should integrate humanism and human factors, respect rural residents, and create a harmonious and lively atmosphere in the maintenance and construction of the community environment. Only in this way can they gradually change their original views and values and achieve a smooth and orderly transition from villagers to residents.

3.2 Establish a green property management system

The implementation of an effective green management mechanism is the basic guarantee for comprehensive green management. Property management companies should formulate specific and feasible development plans and measures for new residents. They should gradually establish a long-term and effective mechanism for the comprehensive coordination of green property management under the new urbanization mechanism, and promote the management of new types of urbanized green property. Property management companies should increase the transparency of management and let residents understand green property management through bulletin boards and symposiums. Meanwhile, the property should always listen to the residents' opinions and receive the feedback of them.

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A Game Theoretic Framework for Cognitive Radio Networks Using Adaptive Channel Allocation Spectrum

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Abstract— *In this research, we propose a game theoretic framework to investigate the behavior of the cognitive radio networks for distributed adaptive channel allocation. We illustrate two separate objective functions for spectrum sharing games, which capture the benefit of selfish users and cooperative users, respectively. Based on utility definition for cooperative users, we determine that the channel allocation problem can be formed as the potential game, and converges to a deterministic channel allocation Nash equilibrium point. Alternatively, no regret learning implementation is proposed for both scenarios. Also, it is pointed to have similar performance with the possible game when cooperation is expected, but with a higher variability beyond users. The no regret learning formulation is beneficial to accommodate selfish users. Non-cooperative learning games have very low overhead for information interchange in the network. We point that cooperation-based spectrum sharing protocol improves the overall network performance at expense of an extended overhead needed for information exchange.*

Keywords— Spectrum Etiquette, Adaptive Channel Allocation, Cognitive Radio, Game Theoretic Framework.

I. INTRODUCTION

With new paradigm shift in the FCC's spectrum management policy [3] that generates opportunities for new, more competitive, reuse, cognitive radio technology sets the foundation for deployment of smart flexible networks that cooperatively adjust to increase the overall network performance. The cognitive radio terminology was invented by Mitola [15], and introduces to a smart radio which has the powers to sense the external conditions, learn from the past, and make intelligent judgments to adjust its transmission parameters according to the current state of environment. The possible participation of cognitive radios to spectrum sharing and an initial framework for precise radio protocol have been discussed in [16]. According to the suggested protocol, the users should adopt to the environment, determine the radio temperature of the channels and determine the interference contributions on their neighbors. Based on these measures, the users should respond by changing their transmission parameters if some other users may require to use the channel. While it is obvious that this behavior improves cooperation between cognitive radios, the behavior of networks of cognitive radios working distributed resource allocation algorithms is limited well known.

As cognitive radios are really autonomous agents that are absorbing their environment and optimizing their performance by changing their transmission parameters, their interactions can be modeled utilizing a game theoretic framework. In this framework, the cognitive radios are the players and their performances are the selection of different transmission parameters and new transmission frequencies, which change their own performance and the performance of neighboring players. Game theory has been widely applied in micro economics, and only recently has received attention as a useful mechanism to design and analyze distributed resource allocation algorithms. So, the spectrum sharing problem was analyzed in [7] that based on a game model among providers using bargaining strategies. In [7], the bound of price of anarchy was investigated under the assumption that users are uniformly distributed, or every AP uses same transmission power. Some game theoretic models for cognitive radio networks were conferred in [18], which has recognized potential game formulations for power control, call admission control and interference delay in cognitive radio networks. The convergence conditions for different game models in cognitive radio networks were studied in [19].

In this research, we propose a game theoretic framework of adaptive channel allocation problem for cognitive radios. Our current research assumes that radios can estimate the local interference temperature on different frequencies and can improve by optimizing the information transmission rate for a given channel quality using adaptive channel coding and by possibly changing to a different frequency channel. The cognitive radios' decisions depend on their perceived utility associated with each possible action. We introduce two different utility definitions, which indicate the amount of cooperation enforced by the spectrum sharing protocol. We design adaptation protocols based on both potential game formulation and no regret learning algorithms. We investigate the convergence properties of the proposed adaptation algorithms and tradeoffs involved.

II. SYSTEM MODEL

The cognitive radio network consists of a set of N transmitting-receiving nodes, consistently distributed in the square region of dimension D∗ × D∗. We assume that the nodes are either fixed or moving slowly (slower than the convergence time for the recommended algorithms). Fig. 1 shows lines to join the transmitting node to its intended receiving node. The nodes contain the spectrum availability and decide on the transmission channel.

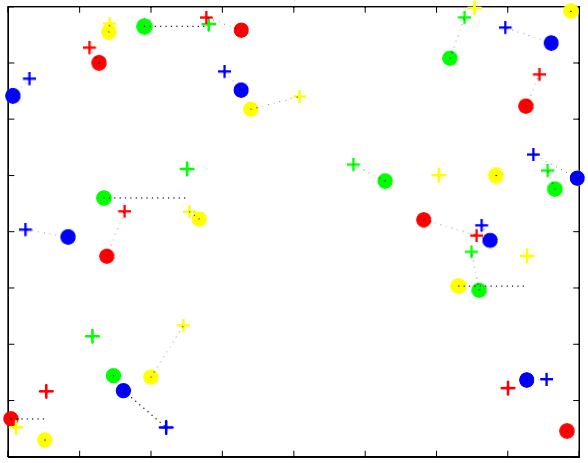


FIG. 1. Snapshot of nodes' positions and network topology

We assume that there are K frequency channels used for transmission, with $K < N$. By distributive choosing a transmitting frequency, the radios effectively form a channel reuse distribution map with decreased co-channel interference. The transmission link property can be characterized by a required Bit Error Rate (BER) target, which is particular to the given application. An equivalent SIR point requirement can be determined by the modulation type and amount of channel coding. The Signal-to-Interference Ratio (SIR) estimated at the receiver j associated with transmitter i can be represented as:

$$SIR_{ij} = \frac{p_i G_{ij}}{\sum_{K=1,K\neq 1}^{N} p_k G_{kj} I(k,j)} \tag{1}$$

where p_i is transmission power at transmitter i, tt_{ij} is the link gain among transmitter i and receiver j. Also, $I(i, j)$ is interference function characterizing the interference produced by node i to node j. Analyzing (1), we observed that to maintain a certain BER constraint the nodes can adjust at both physical and network layer level. At the network level, the nodes can reduce the interference by selecting the transmission channel frequency. At the physical layer, power control can reduce interference for a feasible system, results in all users meeting their SIR constraints. Alternatively, target SIR requirements can be modified (reduced or increased) by using different modulation levels and various channel coding rates. For example, adaptation at the physical layer, we have assumed that for fixed transmission power level, software defined radios enable nodes to adjust their transmission rates and the required SIR targets by changing the amount of channel coding for a data packet. For our simulation, we have assumed that all users have packets to transmit at all the times.

TABLE 1

Code Rates of Reed-Muller Code RM (1, *m*) and Sir Requirements for Target BER=10^{-3}

m	Code Rate	SIR (dB)
2	0.75	6
3	0.5	5.15
4	0.3125	4.6
5	0.1875	4.1
6	0.1094	3.75
7	0.0625	3.45
8	0.0352	3.2
9	0.0195	3.1
10	0.0107	2.8

Multiple users are allowed to transmit at the same time over a shared channel. We assume that users in the network are identical, which means they have an identical action set and identical utility purposes associated with the possible actions. The BER specification selected for simulations is 10−3, and we assume the use of a Reed-Muller channel code RM (1, m). In table 1, we confer the coding rate sequences and the identical SIR target requirements used for our simulations [13].

III. A GAME THEORETIC FRAMEWORK

Game theory depicts a set of mathematical tools produced for the purpose of analyzing player's interactions in the decision processes [8]. It can be used to predict the result of the interactions and to identify optimal strategies for the players. The main elements of a simple game (strategic and rational), their set of actions or decisions and a set of preference connection associated with every action tuple (usually measured by means of the utility function).

In particular, we can show our channel allocation problem as a result of a game, in which the players are communicating channel and their preferences are associated with quality of the channels. The quality of the channels is determined by the cognitive radios by measurements on separate radio frequencies. We show our channel allocation problem as a normal form game, which can be mathematically described as $\Gamma = N,\ S_i\ i \in N,\ U_i\ i \in N$, where N is the finite set of players (decision makers who choose a particular channel to transmit), and Si is the set of policies associated with player i (channels which could be selected by i). We define $S = S_i$, $i\ N$ as strategy space, and $U_i: S\ R$ as the set of utility purposes that the players associate with their strategies. For every player i in game Γ, the utility function Ui is a function of si, the strategy chosen by player i, and of the current policy profile of its opponents: $s-i$. The utility of user i in our channel allocation game can be counted as the reward received by user i from the network depending on the channel it selects, si, and on the other users' preferences, $s-i$. We will explain shortly how the choice of the utility function affects the outcome of the game. In explaining the outcome of the game, as players make decisions independently and are determined by the other players' decisions, we are involved to determine if there exists a convergence point for adaptive channel selection algorithm, from which no player would deviate anymore, i.e. Nash equilibrium. If equilibrium strategy profile is deterministic, a pure strategy Nash equilibrium survives. For finite games, even if pure strategy Nash equilibrium does not exist, a mixed approach Nash equilibrium can be observed (equilibrium is defined by a set of probabilities assigned to pure strategies).

While it becomes apparent from the above discussion, the performance of the adaptation algorithm depends significantly on selection of utility function which characterizes the preference of a user for a particular channel. The choice of the utility function is not unique. It must be chosen to have physical meaning for the particular application, and also have appealing mathematical properties that will guarantee equilibrium convergence for the adaptation algorithm. We have proposed two different utility functions that capture the channel quality and the level of cooperation and fairness in sharing the network resources.

3.1 Utility Function

The utility function (U1) we propose accounts for the case of a "selfish" user, which values a channel based on level of the interference perceived on that particular channel. We denoted P=$[p_1, p_2, \dots p_N]$ as transmission powers for the N radios, S=[s1,s2,...,sN] S=$[s_1, s_2, \dots s_N]$ as the strategy profile and $f(s_i, s_j)$ as interference function:

$$f(S_i, S_j) = \begin{cases} 1 & if\ S_i = S_j, transmitter\ j\ and\ i\ choose\ the\ same\ strategy\ (same\ channel) \\ 0 & \text{otherwise} \end{cases}$$

This choice of utility function requires a minimal amount of information for the adaptation algorithm, namely interference measurement of a particular user on the different channels. The second utility function accounts for the interference seen by a user on a particular channel and the interference this particular choice will create to neighboring nodes. The complexity of algorithm implementation will increase for the particular case, as the algorithm will need probing packets on a common access channel for the measuring and estimating the interference a user will create to neighboring radios. The above-defined utility functions characterize a user's level of cooperation and support a selfish and cooperative spectrum sharing etiquette, respectively.

3.2 A Potential Game Formulation

In the previous section, we have presented the choice of utility functions based on physical meaning. However, in order to have excellent convergence properties for adaptation algorithm we have to ensure that these functions possess certain mathematical properties. There are some types of games that have been shown to converge to Nash equilibrium when a best response adaptive strategy is employed. In what follows, we point that for the U2 utility function, we can express an exact

potential game, which concentrates to a pure strategy Nash equilibrium solution. Characteristic of a potential game is the existence of a possible function that exactly reflects any single change in the utility function of any player. The possible function models the information associated with the improvement paths of a game instead of the exact utility of the game [17].

An exact possible function is defined as a function

$$P{:}S \rightarrow R, if\ for\ all\ i, and\ s_i, s'_i \epsilon S_i,$$

If a possible function can be defined for a game, the game is an accurate potential game. In exact potential game, for a change in operations of a single player, the change in the possible function is equal to the value of the improvement deviation. Any potential game in which players practices sequentially converges to a pure strategy Nash equilibrium that maximizes the potential function [17]. For our earlier formulated channel allocation game with the utility function U2, we establish an exact potential function to be

$$Pot(S) = Pot(s_i, s_{-i}) =$$

$$\sum_{i=1}^{N}\left(-\frac{1}{2}\sum_{j=1, j\neq 1}^{N} p_j G_{ij} f(s_j, s_i) - \frac{1}{2}\sum_{j=1, j\neq 1}^{N} p_i G_{ji} f(s_j, s_i)\right) \quad (2)$$

The function in (2) actually reflects the network utility. It can be recognized that the potential game property ensures that an increase in individual users' utilities contributes to an increase of the overall network utility. We show that this section holds only if users take actions sequentially, following the best response strategy.

Hence, to guarantee convergence for the spectrum allocation game, either a centralized or a distributed scheduler should be expanded. In an ad hoc network, the latter solution is better. To this end, we propose random access for decision making in which each user is strong with probability p_a = 1/N. More pointedly, at the beginning of each time slot, each user flips a coin with probability p_a , and, if successful, produces a new decision based on the current values for the utility functions for each channel; unless, the user takes no new action. We perceive that the number of users that attempt to share each channel can be ascertained from channel listening as we will detail shortly. The suggested random access ensures that on ordinary exactly one user makes determinations at a time, but of course has a nonzero possibility that two or more users take actions simultaneously. We have discovered experimentally that the convergence of the game is robust to this happening: when two or more users simultaneously choose channels, the potential capacity may temporarily decrease (decreasing the overall network production) but then the upward monotonic course is re-established.

The proposed potential diversion detailing necessitates that clients ought to have the capacity to assess the competitor channels' utility capacity U2. To give all the data important to decide U2, we propose a flagging convention dependent on a three-way handshake convention. The flagging convention is fairly like the RTS-CTS bundle trade for the IEEE 802.11 convention, yet expected as a call confirmation reservation convention, instead of a parcel get to reservation convention. At the point when a client needs to settle on a choice on choosing the best transmission recurrence (another call is started or ended, and the client is fruitful in the Bernoulli preliminary), such a handshaking is started. As opposed to the RTS-CTS reservation system, the flagging parcels, START, START CH and ACK START CH (END, ACK END) in our convention are not utilized for conceding transmission for the impacting clients, but instead to quantify the impedance segments of the utility capacities for various frequencies and to help with registering the utility capacity. The flagging parcels have a twofold job: to declare the activity of the present client to choose a specific channel for transmission, and to fill in as examining bundles for obstruction estimations on the chose channel. The flagging bundles are transmitted with a settled transmission control on a typical control channel. To streamline the examination, we expect that no crashes happen on the normal control channel. As we referenced previously, the union of the adjustment calculation was tentatively appeared to be powerful in impact circumstances. For better recurrence arranging, it is alluring to utilize a higher transmission control for the flagging parcels than for the transmitted bundles. This will allow clients to become familiar with the potential interferers over a bigger region. For our reproductions, we have chosen the proportion of transmitted powers among flagging and information parcels to be equivalent to 2. We take note of that the U2 utility capacity has two sections: an) a proportion of the obstruction made by others on the ideal client, Id and b) a proportion of the impedance made by the client on its neighbors' transmissions, Io. The initial segment of U 2 can be assessed at the getting hub, while the second part must be evaluated at the transmitter hub. As such, the tradition requires that both transmitter and beneficiary tune in to the control channel and each keep up a data table on all frequencies, like the NAV table in 802.11. In what pursues, we diagram the means of the convention. Convention steps:

1) Bernoulli trial for p_a
   if 0, listen to common control channel; *break*. if 1, go to 2)
2) Transmitter sends START packet that includes current estimates for interference created to neighboring users on all possible frequencies, $I_O(f)$ (this information is computed based on the information saved in the Channel Status Table);
3) Receiver computes current interference estimate for user $I_d(f)$, determines $U2(f) = -I_d(f) - I_O(f)$ for all channels, and decides on the channel with highest U 2 (in case of equality, the selection is randomized, with equal probability of selecting channels);
4) Receiver includes newly selected channel information on a signaling packet START CH which is transmitted on the common channel;
5) Transmitter sends the ACK START CH which acknowledges the decision of transmitting on the newly selected frequency and starts transmitting on newly selected channel;
6) All the other users (transmitters and receivers) heard the START CH and ACK START CH packets update their Channel Status Tables (CST) accordingly.

We take note of that when a call closes, just a two-way handshake is required (END, ACK END) to report the arrival of the channel for that specific client. After hearing these finish of-call flagging bundles, all transmitters and beneficiaries refresh their CSTs as needs be. We can see that an alternate duplicate of the CST ought to be kept at both the transmitter and the beneficiaries (CST t and CST r, separately). The passages of each table will contain the neighboring clients that have asked for a channel, the channel recurrence, and the evaluated connection gain to the transmitter/recipient of that specific client (for CST r and CST t, separately).

The proposed potential diversion structure has the preferred standpoint that a balance is achieved quick if a best reaction dynamic is pursued, yet requires significant data on the impedance made to different clients and extra coordination for successive updates. We note, be that as it may, that the successive updates strategy likewise settles the potential clashes which may happen after getting to the normal control channel. The potential amusement detailing is reasonable for planning a helpful range sharing manner, however can't be utilized to dissect situations including narrow minded clients, or situations including heterogeneous clients (with different utility capacities relating to various QoS prerequisites). In the accompanying segment, we present an increasingly broad plan approach, in light of no-lament learning strategies, which reduces the previously mentioned issues.

3.3 Φ-No-Regret Learning for Dynamic Channel Allocation

While we appeared in the past segment that the amusement with the U2 utility capacity fits the structure of a correct potential diversion, the U1 work comes up short on the vital symmetry properties that will guarantee the presence of a potential capacity. So as to break down the conduct of the narrow-minded client's amusement, we resort to the execution of adjustment conventions utilizing lament minimization learning calculations. Learning calculations decide probabilistic methodologies for players by thinking about the historical backdrop of play. A learning calculation is described by two stages: investigating and misusing [9]. In the investigating stage, the players endeavor to locate the best activities by investigating the whole space of activities. This is accomplished by choosing all activities with a non-zero likelihood. The misusing stage job is to build the determination likelihood of fruitful methodologies. This sort of learning calculations has customarily been portrayed by lament estimates, for example, outside and inner lament, and were not identified with balance ideas. Outside lament is characterized as the contrast between the adjustments accomplished by procedures endorsed by the given calculation and the settlements gotten by playing some other settled arrangement of choices in the most pessimistic scenario. Inward lament is characterized as the contrast between the settlements accomplished by the systems endorsed by the given calculation, and the adjustments that could be accomplished by a re-mapped arrangement of these procedures. On the off chance that the result contrast approaches zero, the calculation is said to show no-lament.

All the more as of late, thinks about have been performed to relate the execution of the lament minimization calculations to diversion theoretic equilibria [10]. All the more explicitly, in [10], a progressively broad class of no-lament learning calculations called Φ-no-lament learning calculations were appeared to be identified with a class of equilibria named Φ-equilibria. For this class of learning calculations, Φ decides the arrangement of techniques against the present play ought to be thought about. A learning calculation is said that fulfills Φ-no-lament, if no lament is experienced by playing as the

learning calculation endorses, as opposed to playing as indicated by any change of the calculation's play, described by the parts of Φ. No-external regret and no-internal mourn learning estimations are exceptional examples of Φ-no-mourn learning count. It is showed up in [10] that the observational spread of play of Φ-no-lament calculations joins to a lot of Φ-equilibria. It is additionally demonstrated that no-lament learning calculations can possibly learn blended methodology (probabilistic) equilibria, and that the most secure diversion theoretic arrangement idea to which the Φ-no-lament learning calculations merge is the connected harmony. We take note of that a Nash harmony is anything but an essential result of any Φ-no lament learning calculation [10]. We propose a substitute answer for our range sharing issue, in view of the no-outer lament learning calculation with exponential updates, proposed in [4].

$$w_i^{t+1}(s_i) = \frac{(1+\beta)^{U_i^t(s_i)}}{\sum_{s_i' \epsilon S_i}(1+\beta)^{U_i^t(s_t')}}$$

A formal evidence for the intermingling of this learning calculation is difficult to give. In [11], in view of reproduction results, it is demonstrated that the above learning calculation unites to a Nash harmony in amusements for which an unadulterated methodology Nash balance exists. In this work, we likewise appear by recreations that the proposed channel designation no-lament calculation con-borderlines to an unadulterated procedure Nash harmony for agreeable clients (utility U2) and to a blended technique balance for childish clients (utility U1).

By following our proposed learning adjustment process, clients figure out how to pick the recurrence channels which expand their prizes through continued playing of the amusement. For the instance of childish clients, the measure of data required by this range sharing calculation is negligible: clients need to quantify the obstruction temperature at their in-tended collectors (work U1) and to refresh their loads for channel determination in like manner, to support the channel with least impedance temperature (break even with transmitted forces are expected). We take note of that the no-lament calculation in (8) necessitates that the loads are refreshed for every conceivable system, including the ones that were not played at the time. The reward acquired if different activities had been played can be effectively assessed by estimating the obstruction temperature all things considered. For the instance of helpful clients, the data expected to figure 2 is like the instance of potential amusement detailing. We take note of that, while the learning calculation does not require successive updates to unite to a harmony, the measure of data trade on the regular control channel expects coordination to keep away from impacts. One conceivable way to deal with lessening the measure of flagging is keep up the entrance plot proposed in the past area, which would guarantee that by and large just a single client at any given moment will flag changes in channel designation.

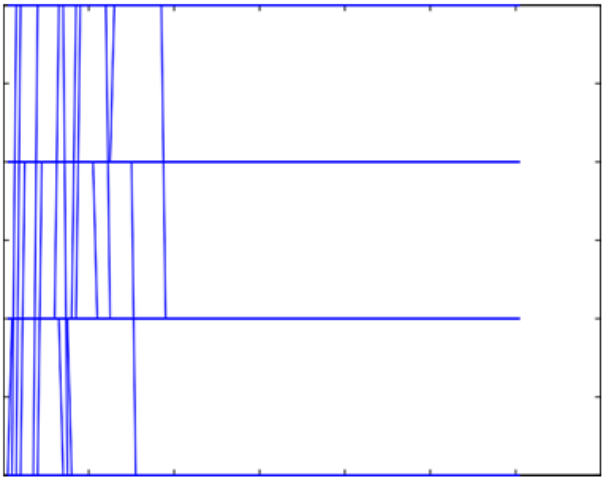


FIG. 2. Potential game: convergence of users' strategies

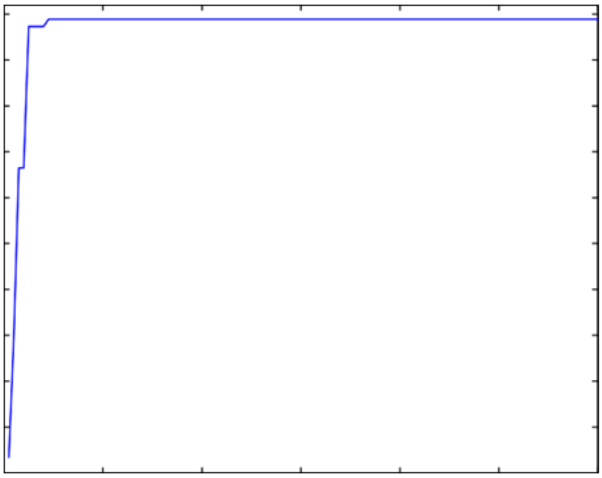


FIG. 3. Evolution of potential function

We initially delineate the intermingling properties of the proposed range sharing calculations. We can see that for agreeable diversions, both the potential amusement plan, just as the learning arrangement meet to an unadulterated system Nash harmony (Figures 2, 4, and 10). In Figure 3, we outline the adjustments in the potential capacity as the potential diversion advances, and it very well may be seen that to be sure by distributivity enhancing their utility, the clients emphatically influence the general utility of the system, which is approximated by the potential capacity. Paradoxically, the narrow-minded clients' learning procedure unites to a blended methodology balance, as it tends to be found in Figures 8 and 9.

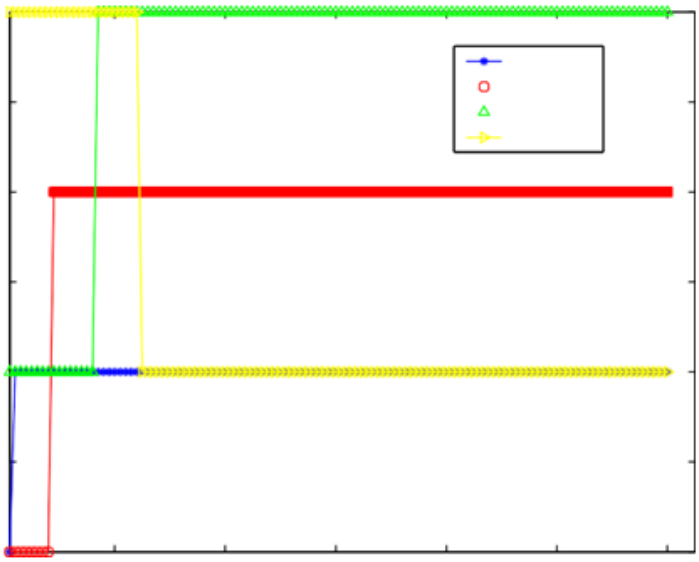


FIG. 4. Potential game: strategy evolution for selected arbitrary users

We consider the accomplished SIRs and throughputs as execution measures for the proposed calculations (versatile coding is utilized to guarantee a certain BER focus, as recently clarified in Section II). We consider the normal execution per client just as the fluctuation in the accomplished execution (reasonableness), estimated regarding change and CDF. We first give results for the potential diversion-based calculation. The decision of the utility capacity for this diversion implements a specific level of decency in dispersing system assets, as it very well may be found in figures 5, 6, 7 and 8. Figures 5 and 6 show the SIR accomplished by the clients on every one of the 4 distinct channels for introductory and last assignments, separately. We can see the SIR enhancement for the clients that at first had a low execution, in spite of the fact that it comes to the detriment of a slight punishment in execution for clients with an at first high SIR. It very well may be found in Figure 7 that at the Nash harmony point, the quantity of clients having a SIR beneath 0 dB has been decreased.

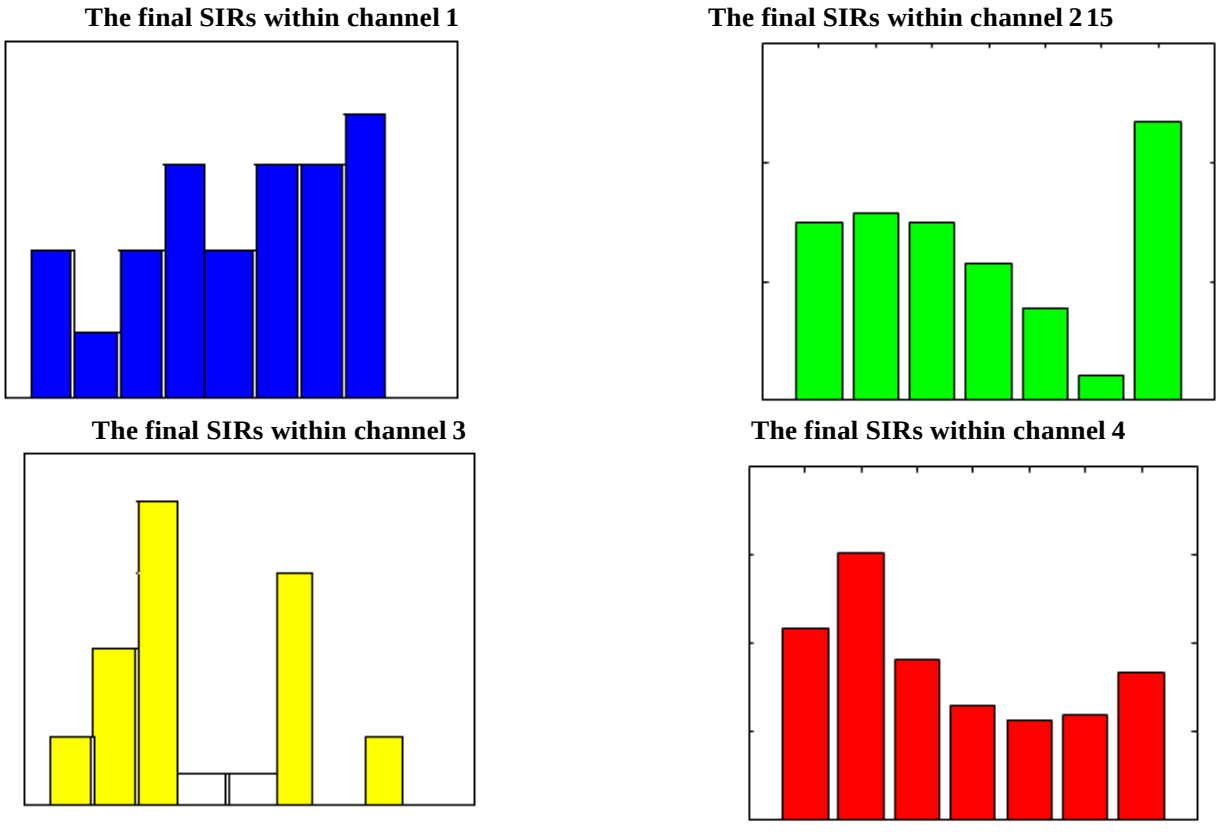


FIG. 5 & 6. Potential Game: SIRs at final channel assignment

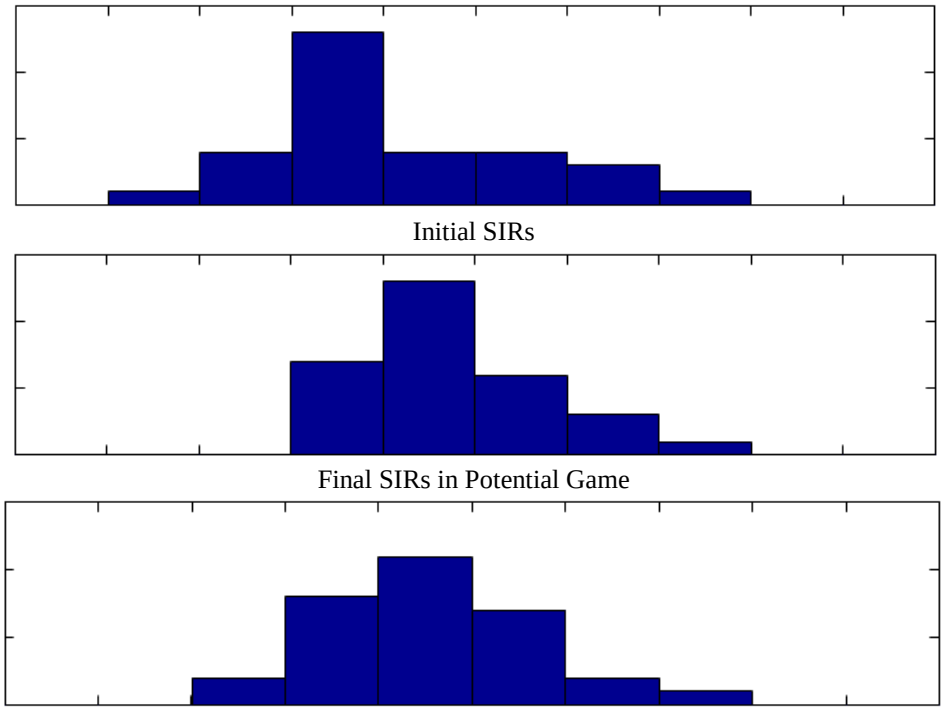


FIG. 7. SIRs histogram. Initial Channel Assignment vs. Final Channel Assignment

Moreover, Figure 8 demonstrates that the level of clients who have a SIR underneath 5 dB diminishes from 60% to about 24%, to the detriment of a slight SIR decline for clients with a SIR more prominent than 12.5 dB. The benefit of the potential amusement is delineated in Figure 9, as far as the standardized feasible throughput at every beneficiary. For the underlying channel task, 62% of the clients have a throughput under 0.75. At the balance, this portion is decreased to 38%. Total standardized throughput upgrades for the potential amusement definition are outlined in Table 2. Our reproduction results indicate fundamentally the same as exhibitions for the learning calculation in agreeable situations with the potential diversion plan. Figures 7 demonstrate the underlying and last task for this calculation, just as the accomplished.

CDF of SIRs over the nodes in Potential Game

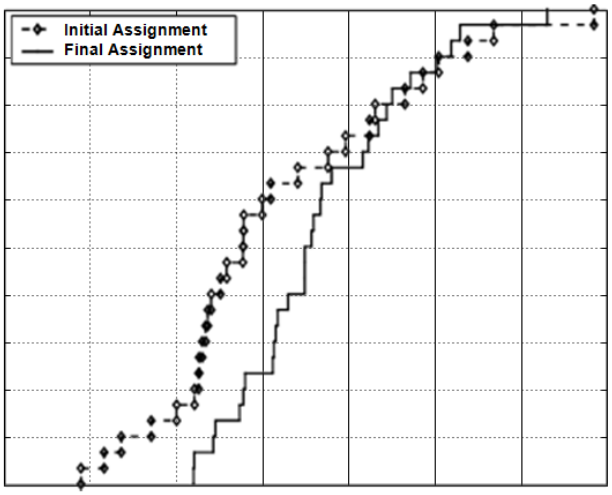
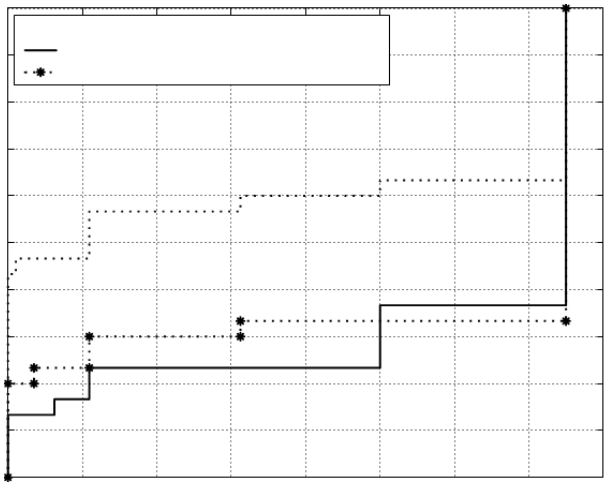


FIG. 8. CDF for the achieved SIRs. Initial Channel Assignment vs. Final Channel Assignment

CDF of Throughputs over the nodes in Potential Game



Value of Throughput

FIG. 9. CDF for the achieved throughputs. Initial Channel Assignment vs. Final Channel Assignment

SIRs after combination for all clients in the system. As far as reasonableness, the learning calculation performs somewhat more regrettable than the potential amusement plan (Figure 9). In any case, despite the fact that the balance point for learning is unique in relation to that of the potential diversion, the two calculations accomplish close throughput execution (Table 2).

As we recently referenced, the learning calculation for narrow minded clients does not prompt an unadulterated procedure Nash balance channel designation. In Figure 8 we outline the union properties for a discretionarily picked client, which unite to a blended procedure portion: chooses channel 1 with likelihood 0.575 or channel 3 with likelihood 0.425. The developments of the loads for every one of the clients in the system are appeared in Figure 9. We think about the execution of the proposed calculations for both agreeable and non-helpful situations.

TABLE 2
SIR AND NORMALIZED THROUGHPUT OF ALL USERS AT INITIAL AND FINAL CHANNEL ASSIGNMENT

	Total Normalized Throughput
Initial Final (Potential Game) Final (Learning U2)	9.4 16.5 15.3

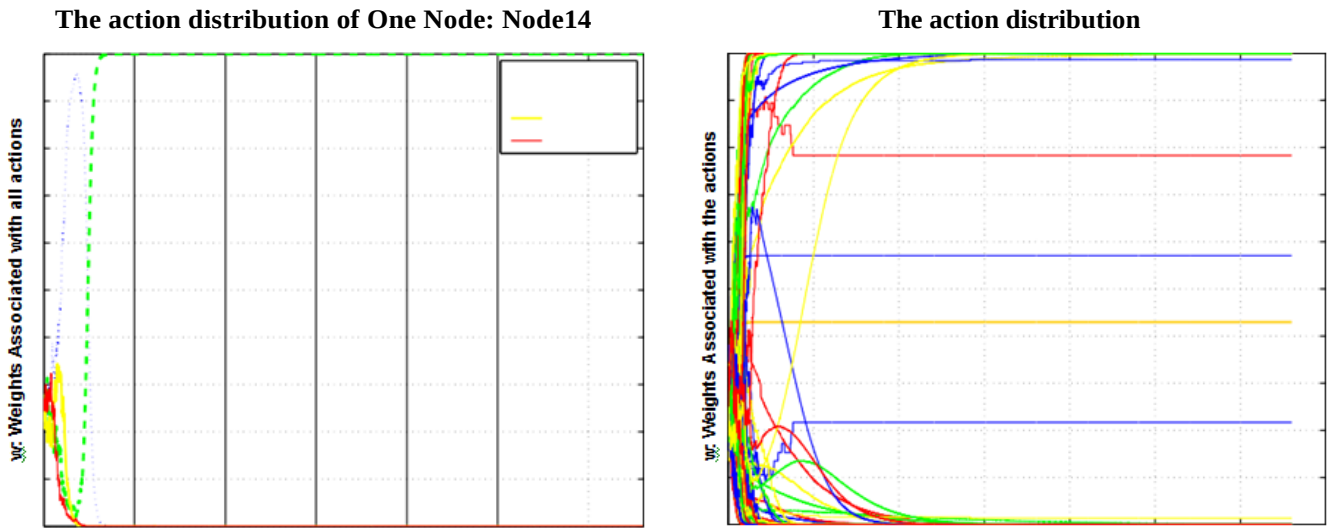


FIG. 10. No-regret learning for cooperative users: weights distribution evolution for an arbitrary user

The execution estimates considered are the normal SIR, normal throughput per client and absolute normal throughput for the system. Toward the start of each availability, each client will either pick a similar balance channel for transmission (in helpful diversions with unadulterated procedure Nash harmony arrangements), or will pick a channel to transmit with some likelihood given by the blended technique balance (for example getting the hang of utilizing U1). In the irregular channel designation plot, each client picks a channel with equivalent likelihood from a pool of four channels.

IV. CONCLUSION

In this work, we have examined the plan of channel sharing decorum for intellectual radio systems for both helpful and non-agreeable situations. Two distinct plans for the channel distribution amusement were proposed: potential diversion definition, and no-lament learning. We demonstrated that all the proposed range sharing strategies merge to a channel portion harmony, in spite of the fact that an unadulterated methodology assignment can be accomplished just for agreeable situations. Our recreation results have demonstrated that the normal execution as far as SIR or reachable throughput is fundamentally the same as for both learning and potential diversion definition, notwithstanding for the instance of narrow-minded clients. In any case, regarding decency, we demonstrated that both participation and allotment methodology assume imperative jobs. While the proposed potential amusement detailing yields the best execution, its pertinence is constrained to helpful situations and huge learning about neighboring clients is required for the usage. On the other hand, the proposed no-lament learning calculation is appropriate for non-helpful situations and requires just an insignificant measure of data trade. This work speaks to an initial phase in understanding the range sharing issue for psychological radio systems. In future work, we will stretch out the proposed answers for location increasingly handy situations, for example, the instance of clients with unequal forces, control-controlled systems, just as the instance of heterogeneous clients, described by various utility capacities.

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Feeding Habits, Length-Weight Relation, and Growth Pattern of Snakehead Fish (*Channa striata*) from The Rice Field of Jejangkit Muara Village, Barito Kuala Regency, South Kalimantan Province, Indonesia

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Abstract*—The research about "feeding habits, length-weight relationship and growth pattern of snakehead fish which caught in rice field JejangkitMuara, South Kalimantan" had been done during June-August 2018which divides into two parts: rice field JejangkitMuara village, Barito Kuala regency, South Kalimantan province for sampling, and identification at Fish Nutrition Laboratory, Aquaculture Department, Faculty of Fisheries and Marine, LambungMangkurat University, Banjarbaru. The aims of the research were to analyze feeding habits, relation between length-weight and growth pattern of snakehead fish (Channastriata) which caught in rice field JejangkitMuara village, Barito Kuala regency, South Kalimantan province. The results of the research showed that the length-weight relation with formula $W = 0.8191\ L^{0,7762}$ with value of r = 0.321092 which mean that length-weight relationships indicated the pattern of negative allometric type of growth (b<3). Snakehead fish has the fish as their primary feeding habits.*

***Keywords*—Channa striata, snakehead, feding habits, length-weight relation, growth pattern, South Kalimantan.**

I. INTRODUCTION

The snakehead fish (*Channastriata*) known as "Gabus or Haruan" is a common freshwater fish species in South Kalimantan-Indonesia. This species is commonly found in rivers, flood plains, rice fields, irrigation canals, ponds, swamps, lakes, marshes, ditches, and estuaries (Saroware*t al*, 2010; Fahmi*et al*, 2013; Akbar, 2017). It is ability to breathe atmospheric air and that can survive in harsh environments with high water temperature, low dissolved oxygen and high ammonia contents (Marimuthu&Haniffa, 2007). It can stay alive without water as long as its gills remain moist. Rice fields have traditionally been the largest source of snakehead fish production. It is one of commercial important, freshwater fish, usually sold fresh in the markets and highly priced because of its good and delicate taste (Qin & Fast, 1998). Its high demand and market price make the species a good aquaculture candidate to culture (Saroware*t al*, 2010).

The fish is widely distributed include China, Pakistan, India, Nepal, Sri Lanka, Bangladesh, Myanmar, Vietnam, Laos, Thailand, Philippines, Cambodia, Malaysia, Singapore, and Indonesia. In Indonesia this species found in the Sumatera, Kalimantan, Jawa, Bali, Sulawesi, Madura, Flores, Maluku, Nusa Tenggara, and Papua (Akbar, 2017).

However in South Kalimantan Province-Indonesia, the culture of snakehead fish is still not common due to the lack of seed supply and knowledge of their feeding and breeding techniques. Niskolsky (1963), found that the primary problems posed in the study of the fish feeding habits, is to have a broad knowledge of the different species of prey in order to understand the qualitative and quantitative bridge between fish and their food organism. Based on Effendie (1979), one of the factors which are determines for fish growth and population is the food.

The fish feeding habits is one of fundamental in fish domestication before the fish is cultured (Akbar, 2017). For that reason, this research had been done to analyzing the relation between feeding habits of snakehead fish (*Channastriata*) and length-weight body of snakehead fish in JejangkitMuara waters, South Kalimantan.

II. MATERIAL AND METHODS

2.1 Time and Place of Research

The research had been done during June to August 2018, which was divided into two steps, that was fish sampling at JejangkitMuara water, South Kalimantan, and where as identification of fish food species in gastric of snakehead fish was done in Fish Nutriton Laboratory, Aquaculture Department, Faculty of Fisheries and Marine, LambungMangkurat University, Banjarbaru, South Kalimantan Province, Indonesia

2.2 Equipment and Material

The equipments used in this research were writing tools, dissecting set, ice box, digital camera, transparent plastic bag, ruler, analytic bean and 1 kg beam. The materials used in this research were alcohol 70%, distilled water, and formalin 4%, snakehead fish (*Channastriata*).

2.3 Procedure

2.3.1 Field Work

Snakehead fish (*Channastriata*) were collected from caught JejangkitMuara water, South Kalimantan. After collecting, the fish were measured on lenght-weight body, and then the fish were dissected to get gastric, and then be stored in formalin 4%.

2.3.2 Laboratory Work

The gastric samples were stored in formalin 4%, and then stored for 10 minutes by using running water and replaced twice to reduce formalin odor. The cleaned gastric samples which were cleaned were stored in alcohol 70% so it can be stored for a long time and can be identified in laboratory. Each gastric sample was dissected to know kind of food containing in the gastric.

2.4 Data Analyzes

2.4.1 Composition and Feeding Habits Analyzes

Food composition was included for everything in snakehead fish gastric, whereas Snakehead fish food was analyzed as follows: the gastric was opened, the contents were measured for the weight, and then the kind of food was grouped. Each kind of food was measured for the weight and be writes for the frequency in the gastric. To know the kind/species eated by snakehead fish was used Index of Preponderance by Effendie (1979).

$$IPi = \frac{Vi \times Oi}{\sum(Vi \times Oi)} \times 100\%$$

Where

IPi : Index of Preponderance one food kind

Vi : Persentage of volume of one food kind

Oi : Persentage of frekuency of one food kind

∑ (Vi x Oi) : Total Vi x Oi of food kind

2.4.2 Length-Weight Relation of Fish

Based on Khan *et al*, (2012), the relation of length-weight was analyzed by formula, as follow: $W = a L^{b}$

Where

W : The total weight (g)

L : The total length (cm)

a : The intercept

b : The regression coefficient

Based on Effendie (1979), there are 3 criteria of fish growth, that is:

If score b < 3, the fish weight growth is slower that the length growth (allometric growth, thin)

If score b = 3, the fish length growth and the fish weigh growth are balance (symmetrically isometric growth, ideal)

If score b > 3, the fish length growth is slower than fish weigh growth (allometric growth, fatty)

III. RESULT AND DISCUSSIONS

3.1. Result

During the research, 22 specimens of snakehead fish had been collected with total length about 15-31 cm and weight about 50-310 g. The dominant total length was 23-26 cm with 8 specimens or 36, 36% (Table 1). This respect was not different with the result of research by Dwirastina, (2007) which got snakehead fish specimens with total length about 15.2-32.4 cm in Musi river of South Sumatera and research results by Nurdawati *et al*, (2014)which report snakehead fish coughed in flood plain of Musi river with total length about 11-49, 5 cm.

TABLE 1
TOTAL LENGHT OF SNAKEHEAD FISH

Total Length (cm)	Length Range (g)	Frequency	Percentage (%)
15-18	16.5	3	13.64
19-22	20.5	5	22.73
23-26	24.5	8	36.36
27-30	28.5	3	13.64
31-34	32.5	3	13.64
Total		22	100

TABLE 2
RELATION BETWEEN TOTAL LENGTH AND WEIGHT SNAKEHEAD FISH

Location	Average		a	b	R^2	r	Growth Pattern
JejangkitMuara	Length (cm)	24,90909	0,8191	0,7762	0,1031	0,3211	allometric growth, thin
	Weight (g)	174,5					

IV. DISCUSSIONS

The observation results to 22 gastric samples of snakehead fish showed that the food composition of snakehead fish which was coughed in rice field JejangkitMuara village was fish (89.28%), macrophyta (2.6%) and materials which cannot be determined (8.12%). The undetermined materials were exist because of the content of fish gastrict had been broken by digestive process and time catching which was not on enough good time.

Based on Burnawi & Yanu (2015) fish (97.15%), prawn (1.73%), detritus (1.10%), and undetermined materials (0.02%). The catching results in the night were bigger than in the noon because of feeding habits of snakehead fish and there was the food in the night.

The food kinds which were gotten in gastric of snakehead fish were fish, macrophyta, and undetermined materials. The research by Marimuthu&Haniffa (2007) also got the frogs, fish, insects, tadpole, and earthworms in gastric of snakehead fish.

The fish dominated gastric content of snakehead fish. This respect because the habitat of snakehead fish in rice field JejangkitMuara village. Condition factor of *Channastriata* fluctuated affected by the difference of age, maturity, environment and food availability in those areas (Makmur, 2004).

The result of calculation from 22 samples collected and this was calculated for length-weight relation, this got the formula as follow:$W = 0.8191\ L^{0,7762}$ with value of r = 0.321092. If r value with average more than 90% in correlation grade, so length-weight relation of snakehead fish is much closed.

Based on the formula above, so it can be known that b value is 0.7762 (lower than 3) which means that the fish grow as allometric growth, thin (the fish weight growth is slower that the length growth). Muthmainnah (2013) stated that snakehead fish in swamp (Sekayu swamp and Manana swamp) South Sumatera grew with allometric growth negative with b value was 2,812 and 2,543. But, that was different with research result of Khan *et al*, (2012), that snakehead fish from Ganga river allometric fatty growth that b value is 3.1210.

The fish was the main food of snakehead fish which had high potential in this rice field. Based on Makmur&Prasetyo (2006), the fish dominated the gastric content of snakehead fish.

V. CONCLUSION

Based on the research result, it was concluded as follows feeding habits of snakehead fish caught in rice field JejangkitMuara village were fish (89,28%), macrophyta (2,6%), and materials which cannot be identified (8,12%). The fish was major food of snakehead fish. Growth pattern of snakehead fish is allometric growth, thin.

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