

## **POLICY AND INSTITUTIONAL ARRANGEMENTS TO ENHANCE WATER USE EFFICIENCY IN IRRIGATED AGRICULTURE IN VIETNAM**

**Le Van Chinh<sup>1</sup>**

**Abstract:** *Irrigated agriculture is the largest water user not only in Vietnam but also all over the world. Improved water use efficiency in agriculture sector has been practiced widespread in many countries. Water use efficiency in irrigation systems in Vietnam is increasingly considered in the context of high water demand and climate change. However, existing policies and institutional regulations for enhancing the water use efficiency remains constraint.*

*This paper assesses of policy and institutional aspects for water use efficiency in irrigated agriculture, focusing on the recent law on hydraulics works, and policies on canal lining and water saving irrigation in 14 provinces in Vietnam. It points out that thanks to these policies results of canal lining and advanced irrigation are considerable. In fact, more than hundred thousand hectares of crops was irrigated with advanced and water saving technologies and about 40% of irrigation canal was lined. This significantly contributes to improving water use efficiency in irrigation sector. However, there are various factors influencing these policies and the law leading to a number of issues and difficulties in implementation. Based on research results, several solutions to policy and institutional arrangements for enhancing water use efficiency in irrigated agriculture are recommended.*

**Keywords:** irrigated agriculture, water use efficiency, canal lining, advanced and water saving irrigation.

### **1. INTRODUCTION**

Water is considered a vital factor for life on earth and plays an important role for economic development. In recent years, demand for water has increased rapidly under pressure of population growth, urbanization and industrial development (Ghazali et al., 2009). The increase in water use demand leads to a serious shortage of water in many parts of the world. Some recent studies on water management indicate that about 30% of the population of developing countries is facing and suffering from water scarcity (Kijne et al., 2003).

Globally, water used for agricultural production accounts for 70% of total freshwater withdrawals (Faurès et al. 2003). In Vietnam, this figure is reported to be 80% (KBR 2009;

MARD 2004). While competition for water among users is increasing, more water is required for food production, leading to a challenge for the agriculture sector in terms of water use. Therefore, water consumed in agricultural sector is considered as an important factor relating to water scarcity.

To improve water use efficiency in water sector, rather than the conventional supply approach, water demand approach is more popularly applied. Water demand management approach includes the following components: (i) external and internal water reuse of the system; (ii) advanced water consumption technologies; land use planning especially at river basin; (iv) education for saving water use and (v) water pricing (Stephen 1997). This study focuses on policy and institutional arrangements, which are important tools of the water demand approach,

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<sup>1</sup> Faculty of Economics and Management, Thuyloi University

for improving water use efficiency in irrigated agriculture.

In fact, Vietnam has pursued a number of policies on enhancing water use efficiency in irrigated agriculture. There are 2 most important policies, which are: (i) The traditional canal lining policy has been applied for decades with significant achievements; and (ii) the new policy on advanced and water saving irrigation, which has recently been enforced.

There were a number of studies on advanced irrigation on crops as Doan Doan Tuan (2011), and Nguyen Viet Anh and Tran Viet On (2009). Results of these studies indicated that advanced irrigation for crops could save water as much as 20% to 40% in comparison with traditional irrigation. As for canal lining, Meijer et al. (2006) and MARD (2004) proved that irrigation water in the lined system could reduce from 30-50%.

In the context of climate change and restructuring of agricultural sector, it is necessary to improve the performance of irrigation management for prevention of drought and saline intrusion (MARD 2014). Therefore, there is a great need of acquiring timely comprehensive solution. In addition to the structure solutions, it is necessary to enhance the completion of mechanisms and policies for improvement of irrigation systems, especially on-farm irrigation systems. It is also required to promote the application of water-saving

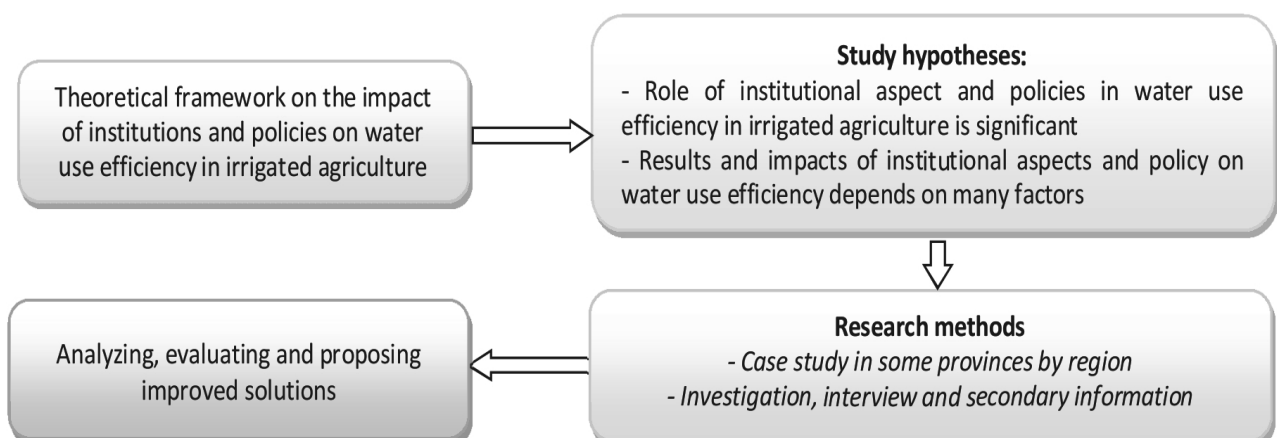
irrigation for advanced farming practices, mobilize participation of all economic sectors in investment and management of irrigation works. In order to solve this problem, the proposed policies need to be renewed and adapted to the approach of user demand

In addition to the current policies on water saving irrigation, on-farm irrigation development, canal lining, Vietnam has recently issued the law on hydraulic works, taken into effect since mid 2018. The law provides the legal framework for improving irrigation services through the promotion of technology in operation, improvement of water quality, as well as the performance of irrigation systems.

There are number of studies on water use efficiency improvement of irrigated agriculture in Vietnam. However, there have been no studies on assessing policy and institutional arrangements for water use efficiency in irrigated agriculture in the context of recently new law. Thus, this study is to (i) assess the *recent policies on canal lining and advanced irrigation* and institutional aspects in the irrigated agriculture and (ii) recommend possible solutions to policy and institutional arrangements for improving water use efficiency in the irrigated agriculture in Vietnam.

## 2. METHOD

### *Research framework*



*Figure 1. Research framework*

Theoretical framework of institutional and policy assessment to improve water use efficiency in irrigated agriculture is developed to analyze the different policies based on region's characteristics. The study considers the main hypotheses related to the importance of the recent law and policies on water use efficiency. These hypotheses are mentioned and analyzed through case studies, field surveys and secondary information from selected irrigation systems. Research framework is shown in Figure 1.

#### *Research site*

This research was carried out in 14 provinces of 5 regions through the country, including (i) Northern region (Ha Giang, Bac Giang provinces); (ii) Red River Delta (Vinh Phuc, Ha Nam, Thai Binh, Nam Dinh); (iii) Central (Nghe An, Quang Tri, Binh Dinh, Binh Thuan); (iv) Central Highlands (Lam Dong, Dak Nong, Kon Tum); và (v) Mekong delta (An Giang).

Secondary data collected comprises legal documents, decisions, data and reports on policy and policy implementation on canal lining, advanced and water saving irrigation at both central and local levels, law on hydraulic works and related documents on guiding and implementing this law. Primary data were surveyed, collected in 14 provinces, through pre-designed questionnaires. The surveyed data includes the content of policy issuance, policy implementation results, assessment of policy implementation results and policy satisfaction (by using a 5 likert scale from 0 as no satisfaction to 4 as absolute satisfaction) of 2 policies: (i) advanced and water saving irrigation and (ii) canal lining. A total number of 70 questionnaires of policy satisfaction was also conducted in these provinces. This survey was carried out from March to June 2018. These surveys were carried out with the support of Directorate of Water Resources and Departments of Agriculture and Rural Development.

### **3. RESULTS AND DISCUSSION**

#### **3.1. Law on hydraulic works, regulations on water use efficiency and relevant stakeholders**

Irrigation has made an important contribution to socio-economic development of Vietnam. In the context of climate change, upstream development impact, risk of water security, to have a legal basis to ensure sustainable development of irrigation and meets the requirements of economic restructuring, in accordance with the market mechanism and international integration, the Law on hydraulic works (hereafter referred to as the law) has recently been issued by the National Assembly and taken effect since July 2018. Water use efficiency of irrigation systems is regulated as a main point of the law including principles, policies and measures for applied technologies in management and operation.

Switching from "*irrigation fee*" to "*irrigation service price*" is a crucial new point to change these activities toward market mechanisms in the context of water demand approach. Implementing the price mechanism will change the perception of the society, making the close and firm linkage of responsibility between the irrigation service provider and the irrigation service users. At the same time, it requires raising awareness and responsibility of irrigation service users, considering the payment of irrigation services as a cost in production, contributing to rational and efficient use of services, especially economical use of water.

A total number of 10 articles (18 items) out of 60 articles of the law (accounting for 16.7% of the Articles) stipulate contents that are directly related to the issue of using water economically from irrigation schemes. Among 8 major policies of the Government on irrigation, the economical and efficient use of water relates to 2 policies on investment and capacity building training and application of science and technology (NA 2017). Especially, the price of

irrigation services, one of the most important and effective tools in controlling and motivating economical water users, which have been practiced worldwide, stipulated in Articles 54 and 55 of the law. This is an important legal basis for the development and application of irrigation service price mechanism in Vietnam in the short-term. After this law issued, several legal documents guiding the implementation of this regulations on advanced and water saving irrigation were promulgated. These legal documents are Decree 67/2018/ND-CP on regulating details of a number of articles of the law on hydraulic works; Decree 77/2018/N/D-CP on support of on-farm and small-scale irrigation schemes and advanced and water saving irrigation; Decree 96/2018/ND-CP on irrigation and non-irrigation service price.

Main stakeholders who are involved in advanced and saving water irrigation include central authorities as Ministries of Agriculture and Rural Development, of Natural Resources and Environment and corresponding local agencies as Departments of Agriculture and Rural Development and of Natural Resources and Environment at provincial and district levels. They are also water service providers as water supply and/or irrigation and drainage management companies and water users like farmers, households and any entities that utilize water for their own purposes. While central and local authorities are responsible for the governance and enforcement of legal regulations in advanced and water saving irrigation, water providers interact with water users via service contracts. Thus, water service pricing becomes an important tools for efficient water use in irrigated agriculture as stipulated in the law on hydraulic works and its relevant regulations toward an approach of water demand management.

### **3.2. Assessment of policies on advanced and water saving irrigation**

*Results of existing policies on advanced and water saving irrigation*

As indicating by international practices, advanced irrigation could save from 30 to 40% of consumed irrigation water (Douglas 2018). Therefore, there has been recently an increasing number of advanced irrigation (sprinkler or/and drip irrigation) and water saving irrigation projects in several provinces such as Lam Dong, Dak Nong and An Giang for different type of crops. These projects are in the form of government investment and/or private public partnership.

The survey results show that, in the surveyed provinces, together with numerous government policies on agriculture development, policies on encouraging the application of advanced and water saving irrigation technologies have been implemented in the study area. Specifically, these polices consists of (i) credit for agriculture and rural development (Decree 55/2015/ND-CP); (ii) support for reducing losses in agriculture production (Decision 68/2013/QD-TTg), and (iii) preferential conditions for efficient water use activities (Decree 54/2015/ND-CP).

To carry out these polices, 5 surveyed provinces have issued specific and detailed guidelines for implementation relevant to their local conditions (Nghe An, Binh Thuan, Binh Dinh, Lam Dong and An Giang). The remaining (9) provinces in the study area have not promulgated any certain instructions. Thus, the access of local people and enterprises to the existing policies on advanced and water saving irrigation are still limited and constraint.

Within the study area, only Ha Giang province has no application of advanced and water saving irrigation for neither paddy nor upland crops. The three provinces of Binh Thuan, Dak Nong, and KonTum have advanced irrigation area of only upland crops while 10 remaining provinces have appied advanced and water saving irrigation for both rice and upland crops with a range area of from several to thousands hectares (Table 1).

**Table 1. Irrigated area by total and by crops of advanced irrigation and water irrigation, and satisfaction level of existing policies**

Province	Total irrigated area (ha)	Rice area by advanced irri. (ha)	Upland crop area by advanced irri. (ha)	Satisfaction level of existing policies
Hà Giang	43,355	-	-	0.5
Bắc Giang	131,100	1,086	3,009.0	1.5
Hà Nam	77,970	1,200	156.1	2.0
Nam Định	187,450	3,120	500.0	1.5
Thái Bình	187,105	7,706	26.2	1.5
Vĩnh Phúc	78,200	1,500	121.0	1.5
Nghệ An	194,120	1,690	1,705.0	2.5
Quảng Trị	54,510	1,850	218.9	1.5
Bình Định	100,280	775	1,700.0	2.5
Bình Thuận	105,800	-	17,982.0	2.0
Dak Nong	9,775	-	1,500.0	2.0
Lâm Đồng	334,650	0.7	51,799.0	3.0
Kon Tum	14,260	-	7,052.0	1.5
An Giang	755,550	15,500	6,338.0	3.0
<b>Total</b>	<b>2,274,125</b>	<b>34.427,7</b>	<b>92,107.2</b>	

Sources: Surveyed data in 2018

Thanks to the implementation of current policies on promotion of efficient water use in irrigated agriculture, upland crop area applying advanced irrigation including drip or sprinkle in the study area increased to 92,100 ha accounting for 34.5% of total advanced irrigation area of upland crop in the whole country. The survey showed that the percentage of advanced irrigation area of upland crop to total irrigated crop area in these provinces is low at 4.1%, higher than that percentage (3.1%) for the whole country. For rice crop, water saving irrigation area is about 34,400, making up 21% of total that of area of the country. The percentage of water saving irrigation area of rice crop to the total rice irrigated area is very low at 1.5% lower than that figure of the whole country. Rice crop area irrigated by water saving technologies in the study area mostly concentrated in the Red River Delta (31%) and Mekong delta (46%). Meanwhile, advanced irrigation of upland crop was almost situated in

mountainous area, especially Lam Dong provinces with 56%.

The analysis found no robust relations between the total crop area of advanced and water saving irrigation and level of policy satisfaction. However, the 2 provinces with the largest water saving irrigation area (An Giang and Lam Dong) have the highest level of satisfaction (3). Meanwhile, Ha Giang province with no crop area of water saving irrigation has the lowest level of satisfaction (0.5). The situation in other provinces could be explained by the fact that the application of advanced irrigation depends on numerous factors.

#### *Limitations of existing policies on advanced and water saving irrigation*

A number of government policies on encouragement of advanced and water saving irrigation technologies have come into effect for many years. However, these policies still have numerous shortcomings during the implementation. The survey illustrates that the level of satisfaction of these policies in the

study area is quite low with the mean value of 1.9, below the average level (Table 1). The high range of satisfaction level, from 0.5 to 3, indicates that effect and achievement of these policies are quite different among provinces. There are various reasons causing to this situation. Local farmers and companies have been facing with many difficulties to access the preferential policies because of lacking information and/or complicated loan procedures. In addition, the coordination between the central and local authorities sometimes failed to function well during the realization of the policies.

There are at least 5 existing legal documents regulating water use efficiency indicating the incomprehensive policy scheme (MARD, 2018). This leads to the difficulty in monitoring and evaluation of policies. Also, possible overlaps of the policy enforcement especially fund support, regime and beneficiaries could negatively influence the effectiveness of these policies. These require a joint and comprehensive legal document integrating all aspects for regulating the efficient water use.

Furthermore, through this investigation, it was found that there was lack of a sound linkage between relevant enterprises and farmers during policy operation. Preferential conditions of loans for installing water saving irrigation system regulated in Decision 68 still have failed to attract commercial banks due to a long waiting for compensation of even low interest. These lead to a limited and low amount of actual loans in these provinces (MARD 2018).

Moreover, current policies seem not likely to mobilize the considerable involvement of private sector especially local enterprises and cooperatives. There are only few enterprises willing to apply of advanced irrigation technologies. The stable production chain relating to irrigated agriculture has not been formed because of high cost in application of advanced and water saving irrigation and unstable market of outputs. Besides, there is a lack of detailed guidelines of technical standard,

norm, unit price for sample models of advanced irrigation (Chinh 2018).

### **3.3. Assessment of policies on canal lining**

#### *Results of existing policies on canal lining*

In general, the national program on canal lining has been considered as an effective policy. The central government policies for this national program include Decision 56/2009/QĐ-TTg and Decision 13/2009/QĐ-TTg by Prime Minister. These policies allow to use government credit for investment of canal lining. According to the survey, canal lining brings significant achievements as lined canal can reduce as much as 35% of irrigation water volume and 30% of irrigation time in comparison with earth canal.

Thus, most of provinces have regarded carefully these policies on canal lining. However, the enforcement of these policies differ among provinces with different objectives and solutions causing the dissimilarity in results. This was proved by the survey results in 14 provinces in the study area. Mountainous provinces had high proportion of canal lining ranging from 40% to 70%, provinces in the Central had the average rate of about 40% whereas delta regions had quite low proportion, less than 20%. According to the investigation, there was not a significant change of lining canal proportion between year 2014 and 2017 except Thai Binh and some mountainous areas.

During the period from 2014-2017, rate of lined canal increased to some extent, lowest at 0.8% in Quang Tri province, highest at 30% in Thai Binh and 7 provinces with a rise of about 10% (Table 2). Provinces with sound policies of detailed objectives and feasible measures as Thai Binh, Ha Giang, Bac Giang and Nghe An are subject to high rate of lined canal. These provinces also have the highest satisfaction level of policies (from about 3.0 and up, Table 2).

Based on the survey data, it was found that there is a linear relation between canal lining rate (2017) and satisfaction level of policy ( $y = 0.0157x + 1.946$  with R square of 0.63). This illustrates the high relevance of the policy to the

mountainous area and dry regions like Central and Central highland (suffering from water shortage) whereas, it not suitable for the Mekong delta (lowest satisfaction).

**Table 2. Results of canal lining period 2014-2017 and satisfaction level**

Province	Canal lining rate up to 2014 (%)	Canal lining rate up to 2017 (%)	Change between 2017 and 2014 (%)	Satisfaction level of existing policies
Hà Giang	53.3	65.9	23.6	3.0
Bắc Giang	31.2	38.7	24.1	3.0
Hà Nam	13.4	13.8	2.7	2.5
Nam Định	5.5	6.0	9.1	2.0
Thái Bình	14.8	19.3	30.3	2.7
Vĩnh Phúc	22.7	23.1	1.8	2.0
Nghệ An	80.2	83.5	4.2	3.5
Quảng Trị	45.7	46.1	0.8	3.0
Bình Định	30.9	34.9	13.1	2.5
Bình Thuận	10.3	10.7	4.3	2.0
DANONE	68.4	72.7	6.3	3.0
Lâm Đồng	62.5	72.2	15.5	2.5
Kontum	41.5	46.9	13.0	2.5
An Giang	1.5	1.8	20.3	1.5

*Sources: Surveyed data in 2018*

In fact, Thai Binh had a flexible and often updated policy that was the grant could be by fund (800 mill VND for 1 km of lined canal) or by material (130-150 tons of cement for 1 km of lined canal). Similarly, canal lining has been considered as first priority in investment policy and often revised in Ha Giang and Nghe An provinces (with highest level of satisfaction 3.5).

Through the investigation of implementation policy, several factors as investment fund, local authority's interest and the involvement of local people are found to have significantly impact on the success of the policies. These findings are confirmed in Nghe An, Thai Binh, Bac Giang and Quang Tri provinces. Investment fund is the most important and decisive factor to the result of canal lining in most of provinces. Almost this fund was from the (central or local) government budget and/or credits for development while the contribution of local people is less than 15%. Recently, lining canal

has been often intergrated into various investment projects or national programs like the new rural development program. These contribute to the considerable achievements in these above mentioned provinces.

#### *Limitations of the canal lining policies*

Fund for canal lining is mostly incorporated in projects or/and national programs and depends significantly on government budget (about 60% of total investment, in the study area). In addition, contribution of local people was limited (about 10%). The government has mobilized fund for canal lining by issuance of bonds, that local government can borrow with the preferential interest of 0% while actual interest is about 6%. That creates the considerable debt for the government. In addition, the constraint on public investment for both central and local government budget lead to many challenges for canal lining program. Thus, fund for canal lining fails to match the actual requirements in the study area, accounting for an average of less than 60%, and also in many places throughout the country (MARD 2018).

### **3.4 Reasons to existing policy and institutional shortcomings**

It was found from the study that awareness and capacity of some staffs in local authorities and local people on efficient water use was limited. Their expectation to rely on central government budget has been quite often and widespread. Public communication and propaganda for delivering information of efficient water use and water saving was not often conducted in many places. Thus, efficient water use has not been considered as a sound foundation for the sustainable development in these places.

The constraint on central and local government budget is one of the important reasons causing limited fund for water saving and water use efficiency and less far from the actual requirements. This has not created the motivation for water service suppliers and users in investment for water saving and advanced technologies.

Policy approach to investment, management and utilization of water in an effective way have not been comprehensive and integrated. Even there is a lack of the synchronous cooperation of interdisciplines. Procedures in policy implementation have not fully carried out, especially the monitoring and evaluation activities. In fact, there is no a monitoring and evaluation system of the implementation of canal lining policy in the study area.

The recent law on hydraulic work and its decrees, especially Decree 77 and 96/ND-CP were to deal with these above constraints mentioned above. However, because of slow and complicated process of compiling and issuing legal documents of guidelines for the law and these Decrees, there has been a lack of detailed instructions for the enforcement of the law. Thus, the effectiveness and enforcement of the law is to some extent still put in question.

### **4. SOLUTIONS TO INSTITUTIONAL ARRANGEMENTS AND POLICY IMPROVEMENT**

Based on current status of existing

institutional and policies found in this study, several solutions to improvement of institution and policy in the context of recently issued law and climate change, are recommended for enhancing water use efficiency as follow.

- It is necessary to speed up the development and issuance of legal documents instructing the law on hydraulic works and government's decrees on efficient water use in irrigated agriculture. These should focus on technical procedures, standards, regulations and norms in operation and maintenance of irrigation systems. Water pricing, which is considered as an effective tool to improve water use efficiency should be applied soon for all water users. The irrigation service price is required to set for specific crops and water users.

- Supporting policies for water saving irrigation and advanced irrigation for both rice and upland crops should be defined in details of conditions, regime and amount of subsidy for relevant people and/or agencies, which are subject to be supported. According to study results, it is required that these policies should be integrated for better operation and monitoring during the implementation. Also, they should be revised for better procedures and conditions that relevant agencies and people would easily access (Douglas 2018).

- Lining canal is very important for water saving in irrigated agriculture, especially in the mountainous and dry regions while effectiveness of canal lining in other regions should be reviewed. A sound policy on canal lining should be continued in the mountainous and dry regions with sufficient fund. This requires a sound and transparent cost sharing regime among governments and farmers.

- The reality in these provinces illustrates that the policies should be designed in a way of making favorable environment that private sector could invest and share responsibility and benefit with governments. This requires facilitating the application of public-private partnership in investment for efficient water use in irrigated agriculture. Objectives and

subjectives of the policies should be clear and specific. These also would be developed based on the actual requirement and characterized by temporal and spatial features as indicated by the 2 surveyed policies.

- For improving the quality and enforcement of policies, a monitoring and evaluation system of the existing policies on water saving and efficient water reuse should be established. This requires a set of criteria and will be operated comprehensively from the local authorities with the possible supervision of stakeholders in implementation stage.

## 5. CONCLUSION

Irrigated agriculture is the largest water user in Vietnam, accounting for about 80% of total annually consumed water. Thus, in the perspective of increasing water demand for competitive water uses for socio-economic development, the improvement of water use efficiency is significantly necessary. The study finds out that the two policies have played significant role in improving the water use efficiency in irrigated agriculture in these 14 provinces. The high variability of results of both policies across the study site indicates that, these policies have influenced by numerous factors including spatial characteristics, fund, the

involvement and contribution of stakeholders. Coordination regime and interest of beneficiaries or investors are also important impact factors to the success of the policies. Lessons learned in the case study are quite useful for the revision of the policies not only for these localities but also for the whole countries.

The recent law on hydraulic works, with various breakthrough points toward water demand management approach, creates a sound legal framework for improving the water use efficiency for multi-sectors especially the irrigated agriculture sector. However, the slow issuing process of some detail guidelines for the law, especially the water pricing policies now has been considered as an obstacle for the enforcement of the law.

Based on the analysis and results of the study, several solutions to policy and institutional arrangements are proposed for enhancing water use efficiency in irrigated agriculture. While the process of law enforcement should be speeded up and improved, the review and revision of the existing policies on water use efficiency would be necessary. An effective monitoring and evaluation system of the law and these policies should be developed for the country.

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### Tóm tắt:

## CẢI THIỆN THỂ CHẾ VÀ CHÍNH SÁCH ĐỂ NÂNG CAO HIỆU QUẢ SỬ DỤNG NƯỚC TƯỚI TRONG NÔNG NGHIỆP Ở VIỆT NAM

Nông nghiệp được tưới là hộ sử dụng nước lớn nhất không chỉ ở Việt Nam mà còn cả trên thế giới. Cải thiện hiệu quả sử dụng nước trong khu vực nông nghiệp đã và đang được áp dụng rộng rãi ở nhiều nước. Ở Việt Nam, việc nâng cao hiệu quả sử dụng nước trong các hệ thống tưới ngày càng được quan tâm khi cạnh tranh giữa nhu cầu sử dụng nước của các ngành ngày càng cao nhất là trong bối cảnh biến đổi khí hậu. Tuy nhiên, những quy định hiện hành về thể chế và chính sách trong cải thiện hiệu quả sử dụng nước tưới còn nhiều bất cập.

Bài báo này nghiên cứu và đánh giá về thể chế và chính sách liên quan đến hiệu quả sử dụng nước trong khu vực nông nghiệp, tập trung vào Luật Thủy lợi mới ban hành, các chính sách về kiên cố hoá kênh mương và tưới tiên tiến, tiết kiệm nước tại 14 tỉnh thuộc 5 vùng. Kết quả nghiên cứu cho thấy, thành tựu của các chính sách này là đáng ghi nhận. Hơn một trăm nghìn ha diện tích cây trồng đã áp dụng công nghệ tưới tiên tiến, tiết kiệm nước và gần 40% chiều dài kênh mương đã được kiên cố hoá trong vùng nghiên cứu, đã cải thiện đáng kể hiệu quả nước tưới. Tuy nhiên, nghiên cứu cũng chỉ ra rằng có nhiều nhân tố ảnh hưởng, gây khó khăn đến việc thực thi luật và chính sách. Dựa vào kết quả phân tích, nghiên cứu đã khuyến nghị một số giải pháp về thể chế và chính sách để cải thiện hiệu quả sử dụng nước trong các hệ thống tưới.

**Từ khoá:** nông nghiệp được tưới, hiệu quả sử dụng nước, kiên cố hoá kênh mương, tưới tiên tiến, tiết kiệm nước.

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