

Voluntary approaches in VOC emission reduction policy in Japan
-architecture and participation-

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Abstract

Voluntary approaches to industry-wide pollution prevention programs have been implemented by many industrialised countries, as a part of policy trend away from a 'command and control' policy approach.

The Japanese government established in 2004 a scheme based on a mix of regulatory and voluntary approaches to reduce emissions of volatile organic compounds (VOC) , calling it a 'best mix'. It aimed to reduce VOC by 30% by 2010 from the 2000 level, by utilising both direct regulations (10%) and voluntary efforts (20%). As a result, it is estimated that the VOC emissions were reduced larger than the target. A total of 43 industrial associations submitted voluntary action plans and the number of the companies participating in the plans reached 9,365.

To date, there are few studies on the policy assessment of the Japanese VOC emission reduction policy. This paper focuses on the participation by the business sector ('Agency') in the voluntary action plans and addresses the question what factors facilitated their participation in the voluntary approach under the VOC reduction scheme ('Architecture'). It tests the existing hypotheses for motivations behind firms' participation in voluntary environmental programs including regulatory threat, market forces and informal mechanisms, by applying them to two sectors with the highest participation according to the capture rates of the sectors' emissions through voluntary action plans. Findings not only show some consistent results with the hypotheses but

also reveal not only commonalities but also differences in the motivations for participating in voluntary action plans between the sectors.

Key words:

voluntary approaches

voluntary environmental programmes (VEPs)

policy-mix

volatile organic compounds (VOCs)

participation

Japanese environmental policy

1. Introduction

Voluntary approaches to industry-wide pollution prevention programs have been implemented by many industrialised countries, as a part of policy trend away from a command and control policy approach (Chittock and Hughey, 2011).

The term voluntary approaches is defined by OECD (1999) as schemes whereby firms make commitments to improve their environmental performance beyond legal requirements, including public voluntary programmes, negotiated agreement and unilateral commitments. To refer to the programmes based on voluntary approaches, various terms are used such as voluntary environment programs (VEPs) (Borck and Coglianesi, 2009; deLeon et al., 2010; Koehler, 2010; Mongenster and Pizer, 2007; Prakash and Potoski, 2010) , public voluntary programs (Lyon and Maxwell, 2010) , voluntary pollution prevention programs (Chittock and Hughey, 2011) and voluntary environmental agreements (Borck and Coglianesi, 2009; Koehler, 2010).

In Japan, various voluntary approaches have been implemented since as early as 1960s. They include the local level voluntary agreements related to pollution control or environmental conservation (Imura, 1999; Imura and Watanabe, 2003; Tsutsumi, 2001; Welsh&Hibiki, 2002), voluntary action plans initiated by the business sector regarding the greenhouse gases (GHG) reduction called the *Keidanren Voluntary Action Plan* (Imura, 1999; Wakabayashi and Sugiyama, 2007), voluntary management of hazardous air pollutants (METI/JEMAI 2004; Omata, 2012), and voluntary action plans in the

areas of reduction of industrial wastes and chlorofluorocarbon.¹ In addition, the scheme to utilise voluntary actions together with legal regulation (best mix) was first employed in the reduction of volatile organic compounds (VOCs) starting in 2005. In the target year of 2010, this scheme resulted in the overachievement of the VOC emission reduction target with participation by 9,365 companies from 43 business associations.

Policy analyses on this VOC emission reduction scheme have been still limited in terms of the numbers and analytical perspectives. Those existing studies include discussion of the current status, challenges, and perspectives of the VOC control scheme (Endo, 2009, 2010, 2011), analysis of productivity of the manufacturers (Fujii *et al*, 2011), researches on the structure of non-participation in the voluntary actions (JEMAI, 2009, 2010b). While the studies by JEMAI (the Japan Environmental Management Association for Industry) addressed the reasons of non-participation in the voluntary actions, few analyses has been done on the motivations behind the firms' participation in the voluntary action plans to reduce VOC emissions in Japan.

The aim of this paper, focusing on the voluntary action plans for VOC emission reduction as a part of the best mix policy, is to analyse the factors which facilitated the participation by the business sector, including business entities, companies and business associations ('Agency') in the voluntary approach as a part of the VOC reduction scheme ('Architecture').

¹ Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council (First meeting), Document 5 "Framework of VOC emission reduction measures" (in Japanese), 1 June 2005.

The structure of this paper is as follows. First, the outline of the contents of the VOC reduction scheme, which consists of both legal regulation and voluntary approach ('Architecture'), is reviewed. Second, the status of participation is summarised and it is shown that the participation patterns differ among the different business associations ('Agency'). The facilitating factors of participation are then analysed with the focus on the two sectors with the highest substantial participation in the voluntary action plans, applying existing hypotheses.

The hypotheses tested in the analysis are the following three explanations on the motivations for firms' participation in VEPs, drawn from Koehler (2010):

- **Regulatory threat:** A most widely proposed drive of firms' participation in VEPs is the threat of regulation or taxation, which prompts industry to either *form* its own VEP (Lyon and Maxwell, 2003) or *join* a public VEP (Segerson and Miceli 1998, 1999; Alberini and Segerson 2002). In other words, it is assumed that firm is more likely to join a VEP if the associated costs are lower compared with the anticipated cost of compliance with (current or expected) government mandates or other schemes (Segerson and Miceli 1998).
- **Market forces:** Alternatively, it is theorised that market forces can shape environmental behaviour of firms. An example is the case that firms perceive a shift in demand and supply toward more green products. Source of market pressures can include not only consumers and suppliers, but also customers, competitors, trade associations, community groups and investors (Henriques and Sardosky, 1996).
- **Informal mechanisms:** Another avenue of research claims that compliance can be

achieved through informal mechanisms. Such mechanisms include shaming and public exposure (Braithwaite, 1989) and the emergence of new values and norms that guide and alter members' preferences for collective action (Hoffman 1997).

In examining those hypotheses, information and publicly expressed views of each sector are drawn mainly from a series of meeting minutes of the Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council. The Council is an official organization that responds to inquiries from the Ministry of Economy, Trade and Industry (METI). The Joint Working Group was established under the Industry and Environment Subcommittee of the Council in order to deliberate the status of voluntary actions of business entities regarding the VOC emission reduction as well as the follow-up of the voluntary management of hazardous air pollutants.² The Joint Working Group has consisted of 20-22 members,³ representing various stakeholders including academic experts, business associations, civil societies, public associations, local government and mass media. The first meeting was held on 1 June of 2005 and the most recent meeting (tenth meeting) was held on 26 March 2012. All of those meetings were participated by the representatives of the two industrial sectors focused in this paper, namely, the printing and chemical industries.

² Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council (First meeting), Document 2 "Establishment of Environmental Risk Countermeasures Joint Working Group" (in Japanese), 1 June 2005.

³ The initial number of the members was twenty up to the seventh meeting and was increased to twenty two from the eighth meeting.

2. Architecture of VOC reduction scheme

In February 2004, the Central Environment Council offered to the Ministry of the Environment of Japan (MOEJ) an opinion report on the emission reduction of VOCs.⁴ The report called an attention to the serious ambient levels and health effect concerns related to suspended particulate matter and photochemical oxidants, and pointed out the necessity and urgency to control emissions from stationary VOC sources, which are precursors of both pollutants of concern. It proposed a target to reduce VOC emissions from stationary sources by 30% by the fiscal year 2010 compared to the emission level of the fiscal year 2000. It further recommended promoting effective emission reduction measures to address stationary VOC sources by combining both legal regulation and voluntary approach in an appropriate manner (“best mix”).

In accordance with the report, the Air Pollution Control Law was partially amended. The bill passed the 159th Diet and was promulgated on 26 May. The amended law came into effect on 1 June 2005.⁵

One of the major thrusts of the amendment was the introduction of the concept of the best mix of the policy measures, which had been mentioned in the Basic Environmental Plan since its second version published in 2000.⁶ The amended Law was the first environmental legislation for the Japanese government to put the concept into implementation. The best mix in the VOC emission reduction indicates an appropriate

⁴ Original title in Japanese: *Kihatsu sei yuuki kagobutsu (VOC) no haishutsu yokusei no arikatani tsuite.*

⁵ The enforcement date for the provisions related to VOC emission regulations was 1 April 2006.

⁶ The Basic Environmental Plan is a long-term comprehensive national plan for environmental conservation, stipulated in the Article 15 of the Basic Environment Law (Law No. 91, 1993). The Plan was first formulated in 1994 and revised in 2000, 2006, and 2012.

combination of legal emission control and voluntary actions by business entities to reduce emissions and spread of VOC (Article 17-2).

The emission reduction target was set to be 30%, by the fiscal year 2010 compared to 2000, following the suggestion by the Central Environment Council.⁷ The reasons for the target provided in the above-mentioned opinion report were as follows:

- It is estimated that 30% reduction would improve the attainment rate of the PM in the area under the regulation of the Automobile NO_x/PM Act (estimated based on the best available scientific simulation model at the moment, although there remain some uncertainties regarding the quantitative analysis of the generation of PM and ozone from VOC). The Basic Principle of the Automobile NO_x/PM Act aims to almost attain the environmental standard of PM in the regulated area by the fiscal year 2000.
- It is estimated that the number of monitoring stations that do not exceed the warning level of photochemical oxidants would increase up to 90 % if VOC is reduced by 30 % (estimated based on the same assumptions with the above).

The Central Environment Council's another report regarding the implementation of VOC emission reduction also presented the potential reduction by the legal control to be approximately 10% and voluntary actions be 20 %.⁸

As for the legal control, one of the two components of the policy mix, only large scale emitters of VOCs with potential emissions larger than 50 tonnes per year are subject to

⁷ Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council (First meeting) Document 5 "Framework of VOC emission reduction measures" (in Japanese), 1 June 2005.

⁸ Central Environment Council, "Important matters in the implementation of VOC emission reduction (Report)" [*Kihatsu sei yuki kagobutsu (VOC) no haishutsu yokusei seido no jishi ni atatte hitsuo na jiko ni tsuite (Toshin)*] (in Japanese), 8 April 2005.

regulations. The large scale VOC emitters are obliged to notify the prefectural governor of installation and change of the VOC emitting facilities, comply with the emission standards, and monitor VOC concentrations. Those regulations were designed to be as limited as possible in order to give full considerations to the voluntary approach by business entities. The scale of emitters subject to the legal control in Japan is significantly larger than the same kind of regulation in EU, which applies to the facilities consuming VOCs by approximately 0.5 to 25 tonnes per year (Katsumata, 2008).

The types of the regulated facilities include: painting facilities and drying facilities for painting; drying facilities for adhesives; drying facilities for photogravure or offset printing; drying facilities for production of chemical products; cleaning facilities for industrial production; and VOC storage tanks.

Voluntary actions, the other pillar of the best mix, address the emissions not regulated by the above-mentioned legal regulations, including emissions from small and medium sized facilities below the regulated scale; emissions from other types of facilities than the regulated ones; and diffusion of VOCs from the openings other than emission outlets or outdoor painting.⁹

The adoption of voluntary actions was among the recommendations by the Central Environment Council's opinion in February 2004. It was rationalised on the grounds that:

⁹ Special Committee on the VOC Emission Reduction, Atmospheric Environment Committee of the Central Environment Council, "Emission reduction scheme of VOC" (in Japanese), 30 March 2005.

- The voluntary actions related to hazardous air pollutants successfully reduced both emissions and ambient concentrations through cost-effective measures; and
- There are some uncertainties to quantitatively estimate the formation mechanism of PM and photochemical oxidants from VOC.

Those rationales indicate that the committee expected the voluntary actions would enable emission reduction in cost-effective and flexible manner.

In order to promote voluntary actions, the report by the Special Committee on the VOC Emission Reduction under the Central Environment Council on the implementation of the VOC reduction scheme noted:¹⁰

- It is expected that appropriate measures are to be examined and adopted by appropriate actors including business facilities, companies and industry groups, through actions such as promotion of products with lower VOCs, development of guidelines/plans for VOC emission reduction;
- Specific methodologies and timing of implementation of the systems for information disclosure and verification should be appropriately chosen and conducted, based on the situation in each business facility; and
- Government should consider the measures to facilitate voluntary actions by business entities and monitor/assess the status of actions. Also, it is appropriate to implement promoting measures such as standards (e.g. Japanese Industrial Standards: JIS), inclusion of low-VOC products in green procurement, and environmental labeling.

¹⁰ *Ibid.*

Thus, as for voluntary actions, the measures to be taken for VOC reduction and the systems for information disclosure and verification were left to the discretion of business entities, while the government was expected to facilitate their voluntary actions through various measures.

Financial incentives were provided only to the legal regulation. The facilities under the legal regulation could receive tax benefit if they purchased emission reduction equipment. On the other hand, despite the requests from the business sectors, no financial incentive scheme was introduced to support voluntary action plans.¹¹

This scheme resulted in the successful reduction of VOC emissions. The estimated VOC emission in fiscal year 2010 was 791,420 tonnes per year, while the emission in fiscal year 2000 was 1,416,812 tonnes per year. The reduction rate over the decade was 44.1%, which significantly exceeds the targeted 30% reduction.¹²

The follow-up scheme for VOC reduction is being deliberated by the Special Committee on the VOC Emission Reduction under the Central Environment Council, in response to the consultation by the Minister of the Environment in April 2012.¹³

¹¹ Kotaro Endo, interview by authors, Tokyo, Japan, 13 June 2012.

¹² Atmospheric Environment Committee of the Central Environment Council (35th), Document 3 “Emission inventory of VOC (revised version)” (in Japanese), 9 September 2012.

¹³ Atmospheric Environment Committee of the Central Environment Council (35th), Document 2 “Status of discussion of the Special Committee on the VOC Emission Reduction” (in Japanese), 9 September 2012.

3. Agency of VOC reduction scheme

The VOC reduction scheme involved various stakeholders, including the business entities, companies, business associations, local governments and the national government. The Working Group on the VOC Countermeasures for the Next Period, in its report to review the scheme and consider the next countermeasures, attributes the reduction of VOC emissions to the efforts by business entities and local governments and facilitating policies by the national governments. It takes note of not only the efforts by the business sector to comply with legal regulation and promote voluntary actions, but also the awareness raising through development of manuals and compilation of case studies as well as organisation of seminars by the industry, local governments and the national government.¹⁴ Thus, the participating stakeholders played roles varying from disseminating the information to actually planning and implementing the voluntary actions.

As of the fiscal year 2010, 40 voluntary action plans were submitted by 43 business associations, consisting of 9,365 companies.¹⁵ Table 1 shows the trend in the number of participating groups and companies from the fiscal year 2005 to 2010. It shows that the number of participating business groups steadily increased since the launch of the scheme, while the number of companies decreased compared to the previous year. It should be noted that the decrease in the participating company is mainly due to closure or merge of companies.

¹⁴ Working Group on the VOC Counter Measures for the Next Period, "Report of Fiscal Year 2010" (in Japanese), March 2011

¹⁵ Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council (Tenth meeting), Document 4 "Summary of the voluntary action plans regarding the VOC emission reduction (status of FY 2010)" (in Japanese), 26 May 2012

Table 1

Trend in the number of participating groups and companies (fiscal year 2005-2010)

	Participating business associations	Participating companies
2005	30	9,341
2006	36	10,217
2007	37	9,900
2008	39	9,792
2009	43	9,980
2010	43	9,365

(adopted from the Document 4 of the Tenth Meeting of the Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council)

The reduction rate of VOC emissions through voluntary action plans was approximately 56% in the fiscal year 2010 compared to the level in 2000, increasing from 51% in the previous year. Thus, the reduction rate through voluntary action plans surpassed by far not only the policy target of 30% reduction but also the nationwide total emission reduction of VOCs achieved during 2000-2010 (44.1%). It is worth noting that such reduction was achieved without any financial incentive mechanisms to the voluntary actions.

Difference in participation among the industrial sectors

The Japan Environmental Management Association for Industry (JEMAI) (2010b), as a part of research commissioned by METI, analysed the inventory data of MOEJ, voluntary action plans and statistical data, to identify the sectors to identify the sectors with less participation.

The study compared the national VOC emission data published by MOEJ in March 2009 (A) and estimated emissions by each industry based on the amount reported in voluntary action plans (B)'. By dividing (B)' by (A), emission capture rates through voluntary actions (C) were calculated for each industry.

$$\text{Emission capture rates through voluntary actions (C)} = \text{(B)' / (A)} \times 100 (\%)$$

(A) : Emissions estimated by MOEJ Inventory (each sector)

(B)': Emissions reported by each sector in the voluntary action plans

Figure 1 shows the distribution of the sectors with the estimated capture rates (C) on the vertical axis and emission estimate (A) on the horizontal axis. The report classified the industrial sectors plotted upper left side as the sectors with relatively small amount of VOCs addressed even through voluntary actions while VOC emissions to the environment are relatively large. These sectors include: general construction, unspecified sector, oil/coal product, other wholesale and retail, plastic products manufacturing, transportation machinery and equipment production, and metalware production.

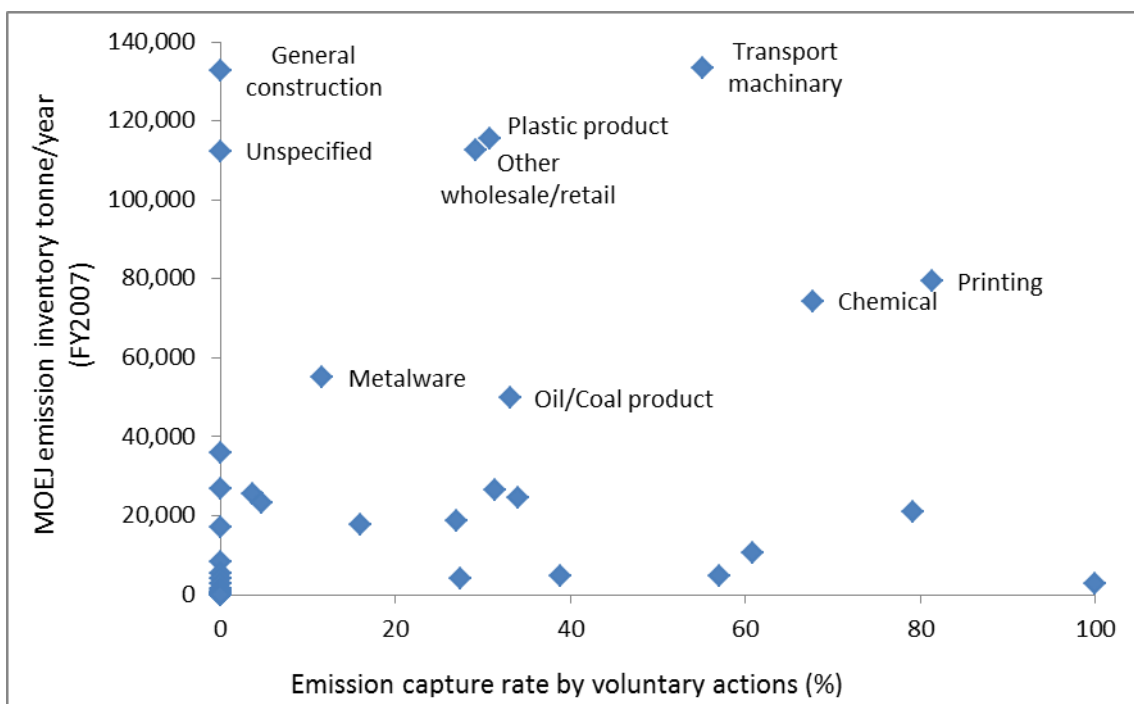


Figure 1

Relationship between emission capture rate in voluntary actions and MOEJ emission inventory (adopted from JEMAI, 2010b)

Note: only sectors mentioned in the text are labeled.

On the other hand, the sectors with plots close to the right edge can be considered as the sectors with high capture rates through voluntary action plans. In the Figure 1, the printing industry and chemical industry are found in such a range. The printing industry emitted 79,357 tonnes per year during the fiscal year 2007 and its voluntary actions captured 81.3 of the total emissions. The chemical industry’s emissions during the same year were 74,380 tonnes per year and the capture rate was 67.8.

The study also found that almost all industries under the jurisdiction of METI have participated in the voluntary actions. Even in the industries with small capture rates,

leading business associations have submitted voluntary action plans. Thus, this scheme could at least facilitate participation by a wide range of industries, while the capture rate depended on each industry.

4. Discussion

As shown above, participation patterns in the voluntary scheme to reduce VOC emissions were significantly different from sector to sector. This section focuses on two sectors with active participation, namely, the printing and chemical sectors, and examines the facilitating factors of their participations comparing with the existing hypotheses. Information regarding those sectors' participation in and attitudes towards the voluntary action plans was mainly drawn from the meeting minutes of the Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council (hereinafter referred to the Joint Working Group).

Printing industry

The printing sector emits a large amount of VOCs in the press process. According to the emission inventory research by the MOEJ, the emissions from the printing sector in the base year (2000) were 135,741 tonnes, comprising almost 9 % of the total VOC emissions (1,487,343 tonnes).

The Japan Federation of Printing Industries (JFPI) submitted the voluntary action plan to METI on 15 December 2005. The plan was as shown in Table 2.

Table 2

Voluntary Action Plan for VOC Emission Reduction of the Japan Federation of Printing Industries

(tonne/year)

Fiscal year	2000	2004	2008	2010
Usage	204,400	199,600	199,600	199,600
Emission	115,500	89,100	78,600	68,100
Reduction rate	---	23%	32%	41%
Reduced amount	---	26,400	36,900	47,400

(source: “VOC emission reduction voluntary action plan and implementation status”)¹⁶

JFPI over-achieved the plan and could actually reduce the emission to 42,700 tonnes, with the rate of reduction of 63% in 2010.

The number of the participating companies in the voluntary action plan was 8,028 in the fiscal year 2005. While the number decreased to 6, 189 in the fiscal year 2010, mainly due to the elimination or consolidation of printing companies, the sector had the largest number of participating companies among the business associations which took part in the voluntary actions. Among the ten member associations of the JFPI, three associations participated in the voluntary action plan. Those groups were the Printers Association of Japan, All Japan Federation of Printing Industry Associations, and

¹⁶ Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council (Tenth meeting), Reference 2 “Voluntary action plans and Implementation Status regarding VOC emission reduction (submitted during the fiscal year 2011)” (in Japanese), 26 May 2012

National Federation of Gravure.

The targeted substances identified in the voluntary action plan were all VOC substances including toluene, ethyl acetate, MEJ, IPA, and high-boiling petroleum solvent. The voluntary action plan specified the measures to reduce those emissions such as introduction of VOC treatment equipment, use of alternative materials and strengthening management.

JFPI implemented its voluntary action plan through various efforts. It published the “Manual for Promotion of Voluntary Actions to Reduce VOC Emissions in the Printing Sector” in the fiscal year 2005. The gravure printing companies, the largest VOC emitter in the printing sector, held meetings to facilitate the information sharing among the business entities regarding their efforts to reduce VOCs (Endo 2011). Endo (2011) notes that the printing sector made an effort to promote voluntary actions by small and medium sized companies, which are not regulated by the legal control, with the aim of not only reducing VOC reductions but also improving the environment, promoting management, reducing cost, and strengthening competitiveness. It was also mentioned that the sector showed a willingness to contribute to build up the sector through sharing technical information, which could have been kept as company secrets.

Thus, it can be said that JFPI was quite successful to facilitate the participation by the members through its various efforts mentioned above, regardless of a relatively large number and small-size companies compared to other participating industry associations.

Applying the three hypotheses of participation, regulatory threat seems to have affected the motivation of the printing sector. The printing industry was already subject to the legal regulation regarding two kinds of facilities, namely, drying facilities for photogravure or offset printing. Although the regulation was applied only to large-scale emitting facilities, failing the voluntary action plans could potentially lead to strengthening of the legal regulation, including the reduction of the exempt conditions or increase in types of regulated facilities.

JFPI's efforts in order to impact the policymaking process of VOC emission reduction scheme indicates the threats that the printing industry had felt before the details of VOC emission control policy were decided. JFPI aimed to reflect their interests in the new scheme and its implementation, by submitting a document to the deliberations in the committees affiliated with the MOEJ, or sending their members to sub-committee meetings regarding technical issues (JFPI, 2005).

With regard to the market forces hypothesis, pressure from the market to the printing industry seems to have been small or negligible. In fact, the discussion at the fifth meeting of the Joint Working Group held on 13 December 2006 implies that the efforts by the printing companies preceded the change in the awareness of the market. Specifically, one of the members raised a point that efforts are needed for not only voluntary actions by emitters but some actions to raise user's awareness.

The third explanation, informal mechanisms, seems to coincide with the motivation by the printing industry. In this case, while little evidence of shaming was identified, the

architecture of the VOC reduction entails the public exposure, by calling on the systems for information disclosure and verification by the business sector. The norm of environmental consciousness as a means to break through the difficult business situation surrounding the printing sector can be regarded as the driver that guided the printing federation's preferences for collective actions. JFPI's positive attitude towards the environmental issues can be found in various systems it has employed. For example, JFPI has developed a third-party certificate system for factories practicing environmentally friendly management (Green Printing Certification System). It also has a system to award excellent environmental-conscious factories. Besides, those efforts on the environment have been strengthened over years (Nikkei BP, 2011).

Thus, the regulatory threat and informal mechanism models are found to be suitable to explain the motivation behind participation by the printing industry. Another factor identified to be important was cost-saving opportunities. Improvement of the competitiveness of the sector, including the cost reduction, seems to have played an important role (Endo, 2011). Those motivations seem to have been backed up by the willingness of the leaders to promote the voluntary action plan and the top-down approach taken by them.¹⁷

Chemical industry

The emissions from the chemical industry in the base year were 133,590 tonnes, slightly less than that of the printing industry. The major process that emits VOCs from the chemical industry is the production of chemical products.

¹⁷ Kotaro Endo, interview by authors, Tokyo, Japan, 13 June 2012.

The Japan Chemical Industry Association (JCIA) was one of the first 21 business associations that submitted the voluntary action plans before the third meeting of the Joint Working Group held in November 2005.¹⁸ In the plan, it set an ambitious target to reduce by 51.8%, as shown in Table 3.

Table 3

Voluntary Action Plan for VOC Emission Reduction of the Japan Chemical Industry Association

Fiscal year	2000	2008	2010
Usage	82,279,092	-	-
Emission	88,809	49,107	42,802
Reduction rate	---	44.7%	51.8%

(source: “VOC emission reduction voluntary action plan and implementation status”)¹⁹

The actual reduction was even larger than planned. The emissions in 2010 were 32,662 tonnes and the reduction rate was as high as 63.2%

Sixty eight companies participated in the voluntary actions, out of its approximately 200 member companies and 80 member organisations. The scales of participating companies were significantly large-scale and the number of VOC species emitted from the industry

¹⁸ Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council (Third meeting), Document 2 “Outline of voluntary action plans regarding the VOC emission reduction in the fiscal year 2005” (in Japanese), 30 November 2005.

¹⁹ Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council (Tenth meeting) Reference 2 “Voluntary Action Plans and Implementation Status regarding VOC emission reduction (submitted during the fiscal year 2011)” (in Japanese), 26 May 2012

was very large.²⁰

During the early discussions of the Joint Working Group, which were held before the development and submission of voluntary action plans, the representative of chemical industry expressed the difficulties their industry are facing, including:

- “JCIA is participated by a number of business organisations, who has small and medium sized member companies. The top level representatives of JCIA, who are from large companies, find it difficult to take a leadership in the entire association.”²¹
- “Compared to the voluntary actions for the hazardous air pollutants with 12 targeted pollutants, VOCs to be reduced exceed 200 species. Thus, voluntary actions for VOC are even more difficult to implement.”²²
- “The industrial scale of chemical sector is very large and wide-ranged. Therefore, it is very difficult to cover the entire sector only by JCIA.”²³

Nevertheless, the chemical industry submitted its voluntary action plan with the ambitions reduction rate and realised a significant reduction. The reasons for JCIA’s high substantial participation and emission reduction despite the stated difficulties seem to include:

- JCIA managed to facilitate the participation by large-scale companies, albeit they

²⁰ Mr. Ito of JCIA, Minutes of the first meeting of the Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council, 1 May 2005.

²¹ *Ibid.*

²² *Ibid.*

²³ Mr. Ito of JCIA, Minutes of the second meeting of the Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council, 8 July 2005.

found it difficult to include all small and medium sized companies²⁴,

- It is inferred that JCIA felt the sense of responsibility to the success of the reduction through voluntary action plans, as the best mix approach was employed through the discussion where chemical industry expressed its opposition to the reliance on legal control (JCIA, 2005).
- Experience in the reporting system of environmental releases of chemical substances, called Pollutant Release and Transfer Register (PRTR) system in Japan, seems to have helped the industries to comprehend the status of emissions and thus facilitated participation.²⁵ Especially, JCIA had extensive experience in this area as it had started to develop their own system prior to the enactment of the Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management (PRTR Law) in 1999. The JCIA PRTR system was also applied to the voluntary management of hazardous air pollutants.

The above indicates that one important drive of the chemical industry's participation was regulatory threat. As one of the backgrounds of the adoption of the best mix was the chemical industry's own opposition to the legal control, there were potential risks that they will lose the grounds to support the voluntary approach if the industry's performance under the voluntary action plans should fail. This drive may well have led the chemical industry to feel the ownership of the scheme as the promoter of the best mix approach. The strategy they took seems to be conservative. The significant reduction was found to be achieved by the participating large companies, rather than by

²⁴ Mr. Ito of JCIA, Minutes of the first meeting of the Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council, 1 May 2005.

²⁵ Kotaro Endo, interview by authors, Tokyo, Japan, 13 June 2012.

seeking further expansion of the number of participating companies, considering the fact that the number of participating companies remained the same throughout the scheme period. Interestingly, however, they found that even non-participating companies had reduced VOC emissions.²⁶

The chemical industry's concerns over further regulation were also reflected in the questions asked during the Joint Working Group. During the sixth meeting, the representative from JCIA expressed the concern as follows:

“The industry's concern is the possibility of request to further reduce VOCs after the fiscal year 2010, if the concentration of photochemical oxidant remains high due to transboundary movement from the continent.”²⁷

Little evidence was found with regards to the hypothesis of market forces and informal mechanisms regarding the Chemical sector, as far as the authors could identify.

5. Conclusion

This paper reviewed the architecture and participation of Japan's VOC emission reduction scheme based on the best mix approach, and examined the business sector's motivations behind the participation in the voluntary action plans in light of the existing hypothesis.

²⁶ Mr. Ishizaki of JCIA, Minutes of the fifth meeting of the Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council, 13 December 2006

²⁷ Mr. Ito of JCIA, Minutes of the sixth meeting of the Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council, 15 February 2010.

It was found that there were differences in the participation in the voluntary scheme of VOC emission reduction. After examining the two sectors which were considered to have participated most actively, from the standpoint of the emission amount and the capture rate, it was also found there were commonalities and differences in the motivations of the participation of that those two sectors.

The printing industry, on one hand, seems to be explained by both the regulatory threat model and informal mechanisms model. The architecture which facilitated the latter motivation of the printing federation could be public reporting scheme. In addition, the opportunity for cost savings and environmental consciousness of the association seem to have played roles. On the other hand, the chemical industry's motivation suits more to the regulatory threat model, to avoid the future regulation. The fact that the best mix scheme resulted from of the policy discussions participated by the industry's representative seem to have made the industry's feeling of responsibility for reduction. It should be noted that those conclusions were drawn mainly from review of literature and meeting records of the governments' working groups as well as one interview with an expert, and thus there are rooms for further refinement with additional sources including interviews with the respective business associations.

As this study examined only two business associations among the 40 participating associations and cover approximately 18% of the total emissions in the base year, further studies will be needed to uncover the motivations of other business sectors. In addition, while this study focused on the motivations of participation, it would be desirable to conduct studies focusing on the effectiveness of the VOC reduction scheme.

In such studies, special attention should be paid to the fact that, while this scheme can be considered successful in meeting the reduction target of VOCs, the ambient levels of photochemical oxidants could not be reduced to the expected level.²⁸ It would be also worthwhile to examine whether the best mix called by the government was actually the best or there could have been better alternatives.

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²⁸ Atmospheric Environment Committee of the Central Environment Council (35th), Document 2 “Status of discussion of the Special Committee on the VOC Emission Reduction” (in Japanese), 9 September 2012.

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