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Supply chain structure and constraints of a rice production community enterprise: Evidence from rural Thailand

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Abstract Supply chain involves actively streamlining a business's supply-side activities to maximize customer value and gain a competitive advantage in the marketplace. In rice production, the concept of supply chain has been explored in several studies across Thailand. However, its current supply chain structure has not been updated to keep up with the emerging constraints in production and marketing, particularly at the level of community enterprises. This study investigated the supply chain structure and constraints of Ban Nong Saeng community enterprise in Chachoengsao province, Thailand. Results revealed that a chain of five major channels comprised the Ban Nong Saeng community enterprise's supply chain as rice moved from the farm to final consumers. This chain includes farmers, primary and final processors, dealers, and local retailers. Farmers produced rice according to Organic Thailand standards. Processors create added value to rice products through product handling, packaging, and branding. Meanwhile, distributors supply packed rice to various local outlets such as Sanam Chai Khet hospital market, Wat Phra That Wayo market, and community farmers' market. However, among the identified constraints were inadequate postharvest management skills at the farmers' level, lack of rice mill certification at the processor's level and poor product packaging quality, and inadequate consumer information at the marketers' level. This research provided the insights into how the supply chain of a rice production community enterprise worked and what improvements are needed to address the existing constraints. Future studies are recommended to formulate strategic guidelines to address each problem identified. This will guide future programs and policies by the government and private sectors.

Keywords: Community enterprise, Supply chain structure, Rice production, Rural Thailand

Introduction

Community enterprises are a distinctive feature of the rural economy of Thailand, supported by the government through various programs and policies (Cramb, 2020). As rice is a key agricultural product, rice production

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community enterprises (RPCEs) have become the most common form of organization in the crop production sector, constituting the highest number among registered enterprises (Petcho *et al.*, 2019). RPCEs dominate the rural areas of Thailand by offering various types of rice products in rural and urban markets. However, because of the complexity of the rice supply chain (Sahavacharin and Srinon, 2016), community enterprises continue to face challenges at present, which limits players' competitive ability (Suksanchananun *et al.*, 2020, Suwanmaneepong *et al.*, 2019). These issues can be better addressed by looking holistically at its present structure using the lens of supply chain analysis.

Supply chain analysis is considered a key competitive strategy to help improve organizations (Stadtler *et al.*, 2014). A supply chain is a complex network of people, processes, and technologies engineered and managed to deliver value to a customer (Reid and Sanders, 2019). Supply chain analysis gives insights into efficient management of goods and services, including all processes that transform raw materials into final products (Swaminathan, 2001). Furthermore, it involves actively streamlining a business's supply-side activities (from demand and supply planning to customer and order management) to maximize customer value and gain a competitive advantage in the marketplace. Three major flows within a supply chain govern its optimal functioning – the product, information, and financial flow. Likewise, optimal chain functioning hinges upon several external factors and constitutes an enabling environment (Albastroiu and Felea, 2013).

Understanding the community enterprise's supply chain would assist leaders and farmer-members to look for competitive advantage that would help them formulate strategies to improve overall chain performance (Stadtler *et al.*, 2014, Suksanchananun *et al.*, 2020). It should be noted that the flows of rice (i.e., paddy or milled), services, and information are affected by the quality and nature of relationships among chain players. Additionally, supply chain performance is governed by external players' policies and programs. Understanding these elements would provide insights into the current forms of linkages and how these facilitate or hinder community enterprises' growth and performance (Kawharu, 2019).

Previous studies have investigated the supply chain structure of rice community enterprises in Thailand using several methods. The latest one was by Suksanchananun *et al.* (2020), who studied the impact of supply chain management competencies and found five indicators: planning, procurement, production, delivery, and return. Suwanmaneepong *et al.* (2019) studied the value chain structure of organic rice mills by community enterprise, and findings provided insights for business model development for more value-

added organic rice products. Moreover, Prasertwattanakul and Ongkunaruk (2015) explored the organic rice supply chain and analyzed its business processes using the integrated definition function modeling (IDEF0) approach. Their findings provide important recommendations and opportunities for supply chain efficiency improvement. However, in recent years, various problems are affecting community enterprises (Naipinit *et al.*, 2016, Somswasdi *et al.*, 2015); and the current supply chain of RPCEs has not been re-examined and updated to keep up with the emerging challenges in input sourcing, production, marketing, and product delivery to consumers. Recent studies have suggested investigating the relationship among chain members (Sahavacharin and Srinon, 2016) and the supply chain structure to maintain a consistent and viable supply chain (Cavite *et al.*, 2021a).

Hence, given the innate complication of the rice supply chain, this study aimed to examine the supply chain structure and constraints of an RPCE. This study used the case of Ban Nong Saeng community enterprise in Sanam Chai Khet district, Chachoengsao province, Thailand. Guided by qualitative techniques, the following research questions (RQ) were formulated.

RQ1. What is the background of Ban Nong Saeng community enterprise?
RQ2. What is the current supply chain structure of the community enterprise?
RQ3. What are the emerging constraints of the community enterprise?

This study's findings would guide future qualitative research which aimed to improve rice community enterprises and formulate strategic options for development. The study is given policymakers an overview of the current supply chain structure and help them fine-tune future programs and policies to help rural farmer adjustment and coping to change the landscape of rice production and marketing in Thailand.

Materials and methods

Study area and sample selection

This study was purposely selected Chachoengsao province, Thailand, a hub of community enterprises in the Central region (Petcho *et al.*, 2019). Ban Nong Saeng community enterprise was chosen because of its evident network of connections with various institutions within and outside the Sanam Chai Khet district (Cavite *et al.*, 2021a). Purposive and convenience sampling techniques were used to gather key informants (CE leader, committee members,

and farmers). The interviews and discussions were conducted from June to September 2020. The map of the study area is shown in Figure 1.

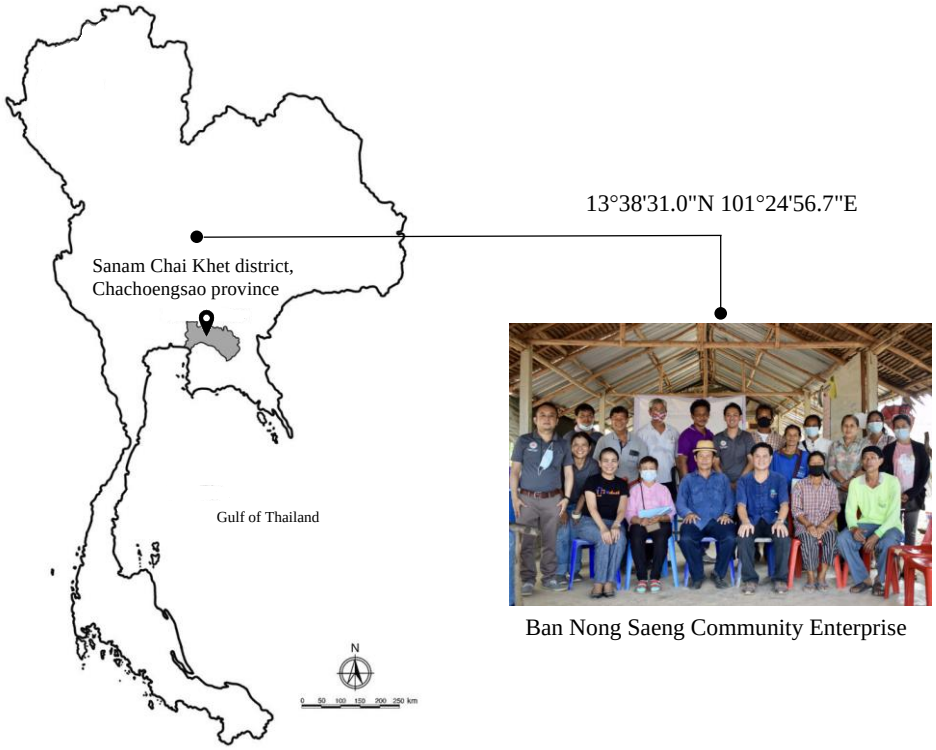

Figure 1. Map of Thailand showing the study area Sanam Chai Khet district, Chachoengsao province, and the community enterprise members

Data gathering procedure

In-depth interview

This study employed in-depth interviews with the community enterprise leader and two committee members to gather actual insights from the community enterprise. The interview gathered information on the community enterprise's background, motivation, and management (Groenland and Dana, 2019). The open-ended questions were formulated to gain information about the enterprise's operation, from buying paddy rice from farmers to distributing milled rice to final consumers. Details about the enterprise's support activities and enabling environment were also gathered. Each interview was done for approximately 45 minutes.

Focus group discussion

For the focus group discussion (FGD), eight farmers were conveniently sampled for a 60-minute group conversation. This method was employed to gain first-hand information of the farmers' experiences as enterprise members. Furthermore, during the interview, the interaction among farmer-participants added more authenticity and richness to the gathered data, allowing the researchers to gain more detailed insights from the participants (Dana and Dana, 2005).

Data analysis

Interview validation and transcription

Interview data were validated first prior to transcription. Validation was done using triangulation. This approach is the most recommended to increase the credibility and validity of research findings (Denzin, 2017). In this technique, the researchers visited the enterprise's actual rice mill and packing facilities. Supporting quantitative information was also obtained with the consent of the enterprise leader. All interview data gathered were then transcribed into text, sorted, and organized (Groenland and Dana, 2019). Themes and patterns that emerged in the data were determined, and categories were developed based on the research questions.

Supply chain mapping and constraints identification

Mapping and analysis of the supply chain activities was done using the grounded theory methodology (Groenland and Dana, 2019, Strauss and Corbin, 1990). Key players and activities from paddy rice purchasing, milling, and distribution to consumers were investigated. Moreover, external agencies supporting the supply chain were also noted. Meanwhile, supply chain constraints were identified through themes that emerged in the data. Results interpretation was supported by a literature review of previous supply chain studies involving community enterprises, primarily in Thailand.

Results

Overview of the community enterprise

Ban Nong Saeng community enterprise is located in Lat Krating subdistrict, Sanam Chai Khet district, Chachoengsao province, Thailand. The enterprise had 46 members, 15 of which were organic rice growers under Organic Agriculture Certification Thailand (ACT), popularly known as Organic Thailand, eight traditional organic rice growers, and 23 Good Agricultural

Practices (GAP) rice farmers. The enterprise was established in the year 2000 and was strengthened through the 'CEs Promotion Act of 2005' and the efforts of its members. The enterprise's main objective was to share and exchange common knowledge on rice production and management, seed selection, and production of fertilizers among members and non-members of the community.

The enterprise's total combined rice area is more than 600 rai (approximate 96 ha), with a total combined rice yield of 101,325 kg from all its farmer-members. Two main rice varieties were planted – the Jasmine Rice (KDML 105) and the riceberry. The enterprise members received rice seed allocation from the Chachoengsao Rice Research Center (CRRC), a government institution. In return, members had to give back the same rice seed variety after cropping with a 10% increase from its original weight received. Aside from the provision of seeds, CRRC also provided technical skills on rice seed production and 'cost and return' calculation to the enterprise members.

The enterprise had its rice milling machine with a maximum milling capacity of 2,400 kg paddy rice per day. However, the enterprise only processed an average of 500 kg per day from available paddy rice from its members. The rice mill operated four days a week, eight hours per day, with one operator. The enterprise allows its members to use the rice mill without monetary charge but collects members' by-products from milling. The income obtained from selling by-products was used for the payment of maintenance and utility expenses. In addition, the enterprise had its farmers' market showcasing its brand of rice products. On top of these, the enterprise also catered to other consumers in various distribution outlets.

Supply chain structure

The supply chain structure of Ban Nong Saeng community enterprise is shown in Figure 2. The enterprise's supply chain comprises three main parts – upstream, midstream, and downstream. The following description is presented according to the three main flows of a supply chain – product, information, and financial flow.

Product flow

The input suppliers and the farmers comprised the upstream part of the community enterprise's supply chain. The enterprise had its fertilizer and seed bank facilities available for members' use. As for membership, the enterprise had a total of 46 farmers; 23 of which were GAP certified rice producers, 15 of which were under Organic Thailand certification, and eight of which produced organic rice under the traditional system (uncertified). The farmers' primary role was to produce rice according to standards. Jasmine rice and riceberry

were the two main rice varieties. The paddy rice produced by farmers goes to the collector. The collector forwards the aggregated paddy rice to the two processors – the primary and final processors. The primary processor mills the collected rice using the enterprise's rice mill. The primary processor had to ensure that the paddy rice was processed according to the enterprises' quality standards. The processing output in this stage is polished rice.

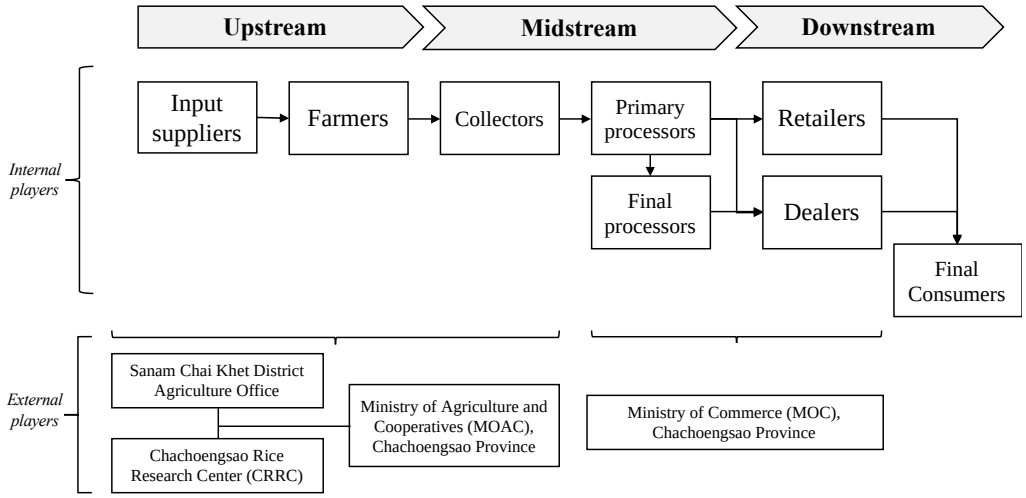

Figure 2. Simplified supply chain structure of Ban Nong Saeng community enterprise, Sanam Chai Khet district, Chachoengsao province, Thailand

Primary processed or polished rice goes to the final processor. The final processor was responsible for adding value to the polished rice through vacuum-packing and branded packaging. The final processor had to ensure that the packaging facilitates the transportation and handling of rice to the distributors and dealers. The community enterprise had four kinds of value-added rice products under the brand 'Pin Phet Farm'. These were the polished Jasmine rice for scoop, vacuum-packed Jasmine rice, vacuum-packed riceberry rice, and polished Jasmine brown rice for scoop. Moving forward the supply chain are the retailers and dealers. Retailers sold both vacuum-packed and scooped rice to consumers within and outside the community enterprise. On the other hand, the dealers sold rice in large volumes at different shops. The interviews revealed that the enterprise distributed rice to different markets situated in PTT Phanom Sarakham, Sanam Chai Khet Hospital, Wat Phra That Wayo, and the community enterprise's farmers' market. Final consumers buy community enterprise's rice products from these markets. These distribution outlets reduced the burden of farmers in finding markets for their rice products. In addition, these outlets helped in marketing communication and encouraged

more consumers to purchase community enterprise rice products. The vacuum-packed rice products of Ban Nong Saeng community enterprises are shown in Figure 3.

Figure 3. Vacuum-packed rice products of Ban Nong Saeng community enterprise

Like most businesses' supply chains, external players also play important roles. This study has found four key players outside the community enterprise supply chain. First, the Sanam Chai Khet district agriculture office supports the community enterprise farmers through sharing technical knowledge on rice production and organizing exhibits to support the marketing of the enterprise's products. These supports enabled the enterprise to sell their rice products to other consumers such as visitors and tourists, aside from the local consumers within their immediate market reach. Second, the CRRC provided open-pollinated varieties (OPV) of quality rice seeds used by farmers, which can also be used in the next growing season. Third, the Ministry of Agriculture and Cooperatives (MOAC) also supports the enterprise in farm record keeping and capacity development. These programs by the ministry are part of their mission in transforming traditional farming into a smart farming system. Finally, the Ministry of Commerce (MOC) provides access to convenient product distribution through opening various channels which allow farmers to sell their products to other outlets. The ministry also supported the development of community enterprise products.

Information flow

As for the supply chain's information flow, farmers' primary source of all information (i.e., technical, input price, and selling price) were their co-farmers. Other farmers also obtained information from the community enterprise group

itself. Social media and television were the least considered by farmers as sources of information. Meanwhile, farmers also get other information from players outside the community enterprise, namely from the district's agriculture office for input and production-related information and the MOAC and MOC for marketing-related information. Moreover, to the consumers, Ban Nong Saeng community enterprise provided information about their different rice products, such as variety-specific information and cooking instructions (i.e., rice to water ratio). The community enterprise also received feedback from its consumers and considered it for future product and service development.

Financial flow

Payment flow of the enterprise's rice (i.e., paddy and milled) was also investigated (Figure 4). It was found that paddy rice products are sold by farmers at an average of 13 THB/kg to collectors. These collectors hand over aggregated rice to processors at the same price. At this stage, the price of both milled and vacuum-packed rice ranged from 18-36 THB/kg, sold by processors to retailers and dealers. Ultimately, consumers purchase the community enterprise's rice products from various distribution outlets. Rice sold per scoop was priced at 40 THB/kg, while vacuum-packed rice products ranged from 60-80 THB/kg.

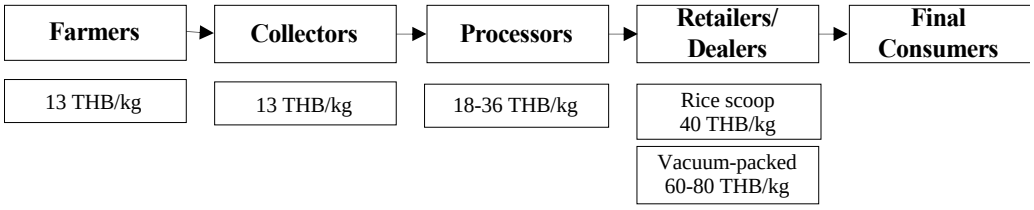

Figure 4. The selling price of rice as it passes through the supply chain (Note: 10 THB = 0.30 USD)

Constraints of the community enterprise

As small farmer organizations, community enterprises are not exempt from various operational constraints. This study found three key constraints encountered by the enterprise in the production, processing, and marketing aspects. First, in the production aspect, farmers reported high costs incurred in rice farming. Most farmers also had no access to irrigation systems during the dry season and lacked proper postharvest management skills owing to farmers' aging population. Second, in the processing aspect, the enterprise was constrained by the low-capacity utilization of their rice mill. It was also

revealed that the actual volume processed was less than the rice mill's processing capacity. It was also found that the rice mill lacks certification, and reportedly, milled rice was of low quality. Third, in the marketing aspect, the enterprise was constrained by inadequate skills in product development to enhance their current product's design. The enterprise still follows the traditional marketing system, which does not target specific market segments. Product traceability integration and online marketing channels are among the emerging trends in product marketing. Inasmuch as the enterprise would like to align with this trend, the enterprise lacks the skill to operate in this type of strategy. In addition, the frequent changes in the rice marketing environment made them unable to adapt to these latest developments.

Discussion

The conventional Thai rice supply chain comprises many members engaged in different activities (Sahavacharin and Srinon, 2016). Typically, rice is produced by small farmers who are the primary chain producer and sells paddy rice to various distributors (e.g., merchants, agricultural cooperatives). RPCEs play a crucial role in sustaining rice production in Thailand. In addition, these small farmer organizations get various government supports which contributed to the improvement of the rice supply chain in the past years (Cavite *et al.*, 2021a, Sathapatyanon *et al.*, 2018). Despite this evidence, the current supply chain structure of RPCEs has not been updated to keep up with the emerging constraints in production and marketing. Thus, this research examined these gaps and presented a more focused discussion of this important form of organization.

Key findings

The current study revealed three key findings. First, the enterprise's supply chain had unique and distinctive features compared to reported chain structures in prior studies (Phuknoi *et al.*, 2018, Prasertwattanakul and Ongkunaruk, 2015). This can be seen by the presence of two types of processors and two downstream players that deliver rice to final consumers. In addition, vertical coordination and information sharing are present in the current supply chain. It gave the opportunity for the community enterprise to sell their rice products extensively (i.e., local, and outside markets). This characteristic is common among community-based organizations (Kramol *et al.*, 2020, Prasertwattanakul and Ongkunaruk, 2018). Vertical coordination in the agri-food supply chain is essential for organizational success as it allows chain players to capture all value additions and improve their financial position

(Mataia *et al.*, 2020, Sathapatyanon *et al.*, 2018). Moreover, the presence of external players also enabled the actors to access production, processing, and marketing supports. This network played a significant role in facilitating the small farmers in the past years.

Second, although the current supply chain resembled the typical enterprise chain structure, some notable features needed to be highlighted. These include owning fertilizer and seed banks, the evident support from various ministries and offices, and the organized flow of paddy and milled rice from farm to consumers. Such observations were indicative of the enterprise's effective efforts in utilizing its external opportunities and internal strengths. These are important strategic moves in any business organization. Collaboration with external players allows the enterprise to utilize other institutions' expertise and access resources not within their current structure (Thitinunsomboon *et al.*, 2008). This strategic option is recommended in a previous study by the same authors (Cavite *et al.*, 2021a).

Third, key constraints across production, processing, and marketing are still evident in the modern supply chain structure. The most common of these problems concern the enterprise's product and marketing. Similar problems were also noted in the studies of Changwatchai and Santipolvut (2015), Sutthisakorn (2013), and Santipolavut and Sripruetkiat (2012). This can be explained by the fact that small farmers are usually constrained by technical knowledge related to product development (Suwanmaneepong *et al.*, 2019). This also explains why the enterprise gets stuck in the traditional rice marketing system. Previous studies have reported similar problems (Naipinit *et al.*, 2016, Rerkasem, 2017, Somswasdi *et al.*, 2015). The latest developments nowadays involved technological advancements over the internet, which the enterprise lacked the skill to operate. Other problems by the enterprise relate to the production aspect as most farmers lack proper postharvest management skills. This problem is common among rice farmers in developing countries and can be explained by farmers' perceived risks and uncertainties when presented with new farming practices or technologies (Kasem and Thapa, 2011).

Implications

As for this study's implication, the authors found two important points tackling theoretical and practical aspects. First, the study is one of the latest attempts to investigate the current supply chain structure of RPCEs in Thailand. RPCEs dominate the rice production sector in rural areas, assisting farmers in their livelihood and income. Understanding the modern supply chain would assist leaders and farmer-members to look for competitive advantages (Stadtler *et al.*, 2014). Moreover, this study did present not only the modern supply chain

structure of RPCEs but also the major constraints that gave insights into the areas needing improvement. This study extends previous findings of the rice supply chain structure in Thailand, particularly in the context of community enterprises.

Second, in a practical sense, the study provided new insights to policymakers, assisting them in formulating specific program interventions based on the identified constraints and supply chain overview. Such a contribution would help enhance the competitiveness of RPCEs as important players of the rice production sector in the rural areas of Thailand. The current findings implied that rice community enterprises need to upgrade their operations along with the emerging concerns (e.g., product design, marketing). Utilizing the latest technologies in online marketing and product development (Cavite *et al.*, 2021b), through collaboration with more capable institutions, would help achieve this goal and consequently reach more consumers for their rice products (Cavite *et al.*, 2021a). The enterprise's problems from production to marketing provide insights to supply chain stakeholders, especially policymakers, to focus on giving more substantial policy support to small farmers on these aspects; thereby helping them adjust and cope with the changing landscape of rice production and marketing in Thailand.

This study concluded that the supply chain structure of Ban Nong Saeng community enterprise involved the following major players; farmers, collectors, processors (rice millers), and distributors. Vertical coordination and information sharing are present in the current supply chain, allowing the community enterprise to sell their rice products extensively in both local and outside markets. However, key constraints across production, processing, and marketing are still evident. The most common of these problems are related to the enterprise's product and marketing, and farmers' inadequate skills for new technology. Practical implications on these aspects are addressed to policymakers. Moreover, this study may have a few limitations. First, the study was conducted in a small group of community enterprise in Chachoengsao province, Thailand making it not generalizable to other large enterprise groups. Second, it focused only on the identification of constraints. Future research may include formulating strategic options and guidelines for community enterprise development based on the current supply chain structure and identified constraints.

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