

Entrepreneurship Sorghum towards Industry 4.0

Endang Noerhartati

¹Agroindustrial Technology Study Program-Engineering
Faculty, ²Department of Education Management

¹Universitas Wijaya Kusuma Surabaya, ²Universitas Negeri
Surabaya
Surabaya, Indonesia
endang_noer@uwks.ac.id

Soepriyono Soepriyono

Department of Civil Engineering
Universitas Wijaya Kusuma Surabaya
Surabaya, Indonesia
priyonohs@yahoo.co.id

Pratiwi Dwi Karyati

Department of Economic Development
Universitas Wijaya Kusuma Surabaya
Surabaya, Indonesia
pratiwidwikarjati@uwks.ac.id

Bambang Yunarko

Department of Law
Universitas Wijaya Kusuma Surabaya
Surabaya, Indonesia
bambang_yunarko@uwks.ac.id

Abstract—The purpose of this research is to develop entrepreneurship based on sorghum by exploring all potential sorghum as raw materials for entrepreneurship towards industry 4.0 that must have creative and innovative ideas in developing entrepreneurship. Observations cover various aspects of the superiority of each aspect of sorghum and advanced statistical analysis. The results showed that raw materials from sorghum which could be used were grain, stems, roots and leaves. The product that can be derived from the raw material such as rice, flour, soft brand, and brand. The field tests showed that the machines and equipment for processing common rice that were easily accessible to farmers could be engineered to process sorghum seeds into sorghum rice. Thus, the processing of sorghum seeds can be done easier and closer to farmers. The machine and hybrid equipment automation are ready to be done by engineering the screen part and blower units. Other results of entrepreneurial products are food products (various cakes, bakery, and cookies), functional drinks, and various fermentation products), health products, and non-food items (cosmetics, batik, and various souvenirs).

Keywords—sorghum; sorghum products; sorghum entrepreneurship; industry 4.0

I. INTRODUCTION

Industry 4.0 is the fourth industrial revolution that describes the digital networking of all people, machines, processes and systems involved in the production. The development of sorghum-based entrepreneurship is the implementation of the results of the research "Development of sorghum as an alternative food" that has been carried out by UWKS since 2009, which finally formed of UWKS as Center for Sorghum Entrepreneurship (CSE) and entrepreneurship networks are created by establishing Sorghum Entrepreneurship Units (SEU) in various places, consisting of students, lecturers, and employees of UWKS, and the community. Sorghum entrepreneurship towards industrial 4.0 program very important for the maximum development of alternative food products

from carbohydrate sources, and in the future can be optimized to be a functional food component [1-5].

The purpose of this research is to develop entrepreneurship based on sorghum by exploring all potential sorghum as raw materials for entrepreneurship towards industry 4.0 that must have creative and innovative ideas in developing entrepreneurship.

II. METHODOLOGY

The research uses qualitative research methods in entrepreneurship, a descriptive qualitative action research. The participants of the research were all sorghum entrepreneurship units (SEUs) that have been formed by Center for Sorghum Entrepreneurship - Universitas Wijaya Kusuma Surabaya (CSE-UWKS). The data was retrieved through a series of observations, completion of questionnaires, and in-depth interviews. Furthermore, the data and information obtained were analyzed statistically and were described to improve the entrepreneurship process to develop sorghum business towards industry 4.0 di Indonesia [3-5].

III. RESULT AND DISCUSSION

A. Sorghum Production

Raw materials from sorghum which could be used were grain, stems, roots and leaves. The product that can be derived from the raw material such as rice, flour, soft brand, and brand.

Successful experience of formation of Industry 4.0 in the countries of the world, the strategic course at practical implementation of the concept of Industry 4.0 and achieved the highest progress in its formation, they were selected as the objects for this research [6-7].

Calculation of 1 ha sorghum yield produces 5-6 tons of sorghum grains, 15 tons of sorghum stem, 4 tons of sorghum leaves, and 1 ton of sorghum root. The percentage of sorghum

production is from 100% sorghum grains producing 70% sorghum rice, 70% sorghum flour, 10% sorghum soft bran, and 20% sorghum bran (figure 1). The whole portion of sorghum plants is very useful as a raw material for entrepreneurship products [8-9].

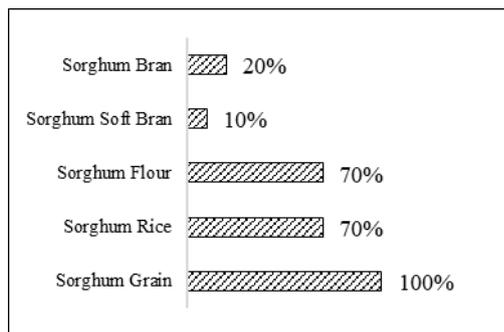


Fig. 1. Sorghum processed products (production of sorghum grains 5-6 tons/ha) [10].

TABLE I. THE NUTRIENT CONTENT OF SORGHUM COMPARED WITH OTHER FOOD RESOURCE

Nutrient Uptake	Content /100 g					
	Wheat	Rice	Sorghum	Cassava	Corn	Soybean
Cal (cal)	365	360	332	146	361	286
Protein (g)	8.9	6.8	11.0	1.2	8.7	30.2
Fat (g)	1.3	0.7	3.3	0.3	4.5	15.6
Carbohydrate (g)	77	78.9	73.0	34.7	72.4	30.1
Ca (mg)	16	6.0	28.0	33.0	9.0	196.0
Fe (mg)	1.2	0.8	4.4	0.7	4.6	6.9
P (mg)	106	140	287	40	380	506
Vit. B1 (mg)	0	0.12	0.38	0.06	0.27	0.93

Source: [11-14].

Sorghum is a cereal plant that has a nutrient content that can be compared with wheat, corn, rice, cassava and soybeans (Table 1). Sorghum also has other advantages in terms of health, namely "gluten free", more fiber, and contains antioxidants. Sorghum contains tannin, and antioxidants. The benefits of sorghum for health are: as nutritious food, containing high fiber so that it is good for digestion, can be used as diabetes control, gluten free which can prevent celiac disease, contains calcium good for bone health, can increase circulation and red blood cell production, increase energy, and cancer prevention [15-18].

B. Sorghum Entrepreneurship Unit (SEU) Production Challenges

TABLE II. DEVELOPMENT OF SORGHUM PLANT POTENTIAL

No	Raw Material	Product
1	Sorghum grain	
	a. Sorghum rice	nasi, bubur, lontong, various cake, tape, tempe

Table 2. Cont.

	b. Sorghum flour:	various cookies & cake, sorghum bakery, noodles, cosmetic product
	c. Sorghum soft bran:	cereal, various cookies & cake, cosmetic product
	d. Sorghum bran:	Animal feed
	e. Sorghum non food:	Sorghum Vase
2	Sorghum stem:	liquid sugar, sorghum stem syrup, bioethanol
3	Sorghum root:	Pharmacy Product
4	Sorghum leaf:	compost, Animal feed
5	Sorghum stem waste:	bagasse, silage, Animal feed, fuel

Source: [19-24].

Table 2 is the result of research that has been implemented by CSE to SEUs shows that development of sorghum plant potential, and Center of Sorghum Entrepreneur (CSE)-UWKS should be implemented continuously in the development of educational entrepreneurship program in order to create new entrepreneurs and to develop sorghum-based product business (figure 2).

The results of interviews are that entrepreneurial products that must have creative and innovative ideas in developing entrepreneurship produced by raw materials of sorghum grains, sorghum rice, sorghum flour, sorghum soft bran, sorghum bran, sorghum stem, sorghum leaves, sorghum root, and sorghum stem waste. While the results of entrepreneurial products are food products (various cakes, bakery, and cookies), functional drinks, and various fermentation products). Other results of entrepreneurial products are health products and non-food products (pharmacy, cosmetics, batik, and various souvenirs) [25-27].

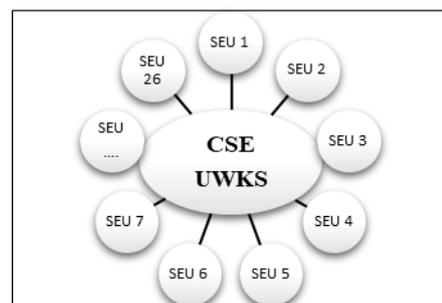


Fig. 2. CSE-UWKS and SEUs [28].

Extracts from various sorghum KD4 containing flavonoids, tannins, triterpenoids, saponins, and phenols. Sorghum methanol extract has the potential as a pharmaceutical product [29].

Scale up of sorghum entrepreneurship using Training, Visit, and Online extension (TVO) system must be carried out including the development of technological packages from research on sustainable sorghum products as the future of healthy food that must be supported by the availability of superior varieties, processing technology, and knowledge about functional food benefits [30].

C. Entrepreneurship Sorghum Towards Industry 4.0

Automation and digitization. The field tests showed that the machines and equipment for processing common rice that were easily accessible to farmers could be engineered to process sorghum seeds into sorghum rice. Thus, the processing of sorghum seeds can be done easier and closer to farmers. The machine and hybrid equipment automation are ready to be done by engineering the screen part and blower units [31].

Online SEU network demands. At present the sorghum entrepreneurship network has emerged and the actors are passionate about increasing their business, this is supported by the sorghum-based trade system that has been running and the machine tools for processing sorghum seeds have been realized, and information on the importance and superiority of this commodity for consumers has been widely publicized.

On the basis of the importance of establishing a collaborative network, sorghum-based business groups (SEU) in their local areas, which cross borders in villages, sub-districts or districts, are carried out by developing more advanced information networks, so that communication between them takes place faster and assisted by using social media as a means of developing business, can encourage online marketing to develop the sorghum business, increasing the progress of SEU, because there are still many product innovation opportunities that can be made which in turn create an increase in demand for sorghum products, and build sorghum database for developing SEU digital network on sorghum website of UWKS [32].

New trade and market systems. The activities of the SES-UWKS team have opened governance alternative commercial sorghum which provides added value to farmers and actor supporters. New market opportunities open because the formulation of superior nutritional value and healthy lifestyle trends will be interesting educated consumers, including consumers from the vegetarian community [33-34].

The process of added value of sorghum products that occurs as a comparison can be seen from the selling price from the yield of sorghum seeds, sorghum rice, this is significantly different from the selling price of sorghum seeds with up-grade quality compared to sorghum seeds commonly used by farmers when selling to conventional markets through middlemen and intermediary traders. Likewise, the selling price of the same type of pastry made from sorghum is 50% adrift even more if the packaging is better. The results of this value-added process are examples that can then be elaborated by SEU processing sorghum with various product innovations that are more valuable for sale. It can be said that the selling prices and value-added processes that occur in the sorghum business are key factors in maintaining the continued development of sorghum in Indonesia.

TABLE III. VALUE ADDED PROCESSES [35]

No	Product	Initial condition a) IDR	New trade system b) IDR
1	Sorghum grain	1,800 – 2,600	4,500 – 6,500
2	Sorghum rice	-	8,000– 12,000
3	Sorghum cookies	-	> 50,000

^a. Initial conditions prior to the introduction of the AR CSE-UWKS module.

^b. Final conditions of research activities. Numbers show price ranges in rupiah per kilogram, except for cookies in 250-gram packaging units.

Changes in the global transformation of the manufacturing industry with the introduction of digitalization and the Internet, taking into account the increase in product diversification, manufacturing operations and product services, that good organizational structures and combination with Industry 4.0 can support entrepreneurs in a new way [36].

IV. CONCLUSION

The importance of developing entrepreneurship based on sorghum by exploring all the potential of sorghum as raw material (seeds, rice, flour, bran, stems, and roots) of sorghum, and supported by creative and innovative ideas in developing entrepreneurial products (food, non-food, healthy, pharmacy and cosmetics) so that in the entrepreneurial process towards industry 4.0 automation has been carried out in the process of preparing raw materials, developing sorghum information through social media, and creating new trade and digital sorghum-based markets.

REFERENCES

- [1] A.R Anderson and R Sebastien, "Towards an Entrepreneurial Theory of Practice; Emerging Ideas for Emerging Economies", *JEEE*, vol. 9 (2), pp. 110-120, 2017.
- [2] E. Noerhartati, T. Widiartin, Maslihah, and N.W. Karsono, "Activity Report of IBIKK Production Center of Sorghum Product at UWKS Year 1", UWKS, 2016.
- [3] A. Fayolle, "Handbook of Research in Entrepreneurship Education", Volume 1: A General Perspective. Northampton, MA: Edward Elgar Publishing Limited, 2007.
- [4] Kemmis, S. and Robin Mc T., "The Action Research Planner", Geelong: Deakin University, 1997.
- [5] A.T Jeffrey, "New Venture Creation: Entrepreneurship in the 1990s" New Business Enterprises, 1990.
- [6] Shirley, "Action Research as on-Going Professional Development", Canberra: Accord, 1995.
- [7] E. Noerhartati, T. Widiartin, Maslihah, and N.W Karsono, "Activity Report of IBIKK Production Center of Sorghum Product at UWKS Year 2", UWKS, 2017.
- [8] E. Noerhartati, "Various Cookies Made from Flour Sorghum Paper Si Unyil TV TRANS 7", UWKS, 2010.
- [9] E. Noerhartati, "Various Industrial Products Made from Wheat and Sorghum", Agriculture Department Provincial Government of East Java, 2010.
- [10] E. Noerhartati, T. Rahayuningsih, and F.S. Rejeki, "Activity Report of IbM Business Group of Sorghum Flour", UWKS, 2013.
- [11] Ministry of Health RI, "List of Food Composition" Jakarta Bhartara, 1996.
- [12] E. Noerhartati, "Product Variety Cookies, Flakes, Sticks, Noodles Sorghum" Proceedings SPRINT LIPI Yogyakarta, pp. 235-238, 2014.

- [13] E. Noerhartati and D. Puspitasari, "Pie Sorghum" Research Report UWKS, 2014.
- [14] E. Noerhartati and D. Puspitasari, "Flake Sorghum", Proceeding FANRes UB Malang, pp. 83-94, 2016.
- [15] FAO, "Sorghum Post-harvest Operations", Food and Agriculture Organization of the United Nations, 1999.
- [16] C.O. Kangama, "Introduction of Sorghum" *AJB*, vol. 4 (7), pp. 575-579, 2005.
- [17] W. Siferow, Evaluation of Sorghum, *IRJASS*, vol. 4, pp. 476-84, 2014.
- [18] P. Imran, "Antioxidant Perspective of Sorghum and Millet", *JFPP*, vol. 39 (6), pp. 1089-1097, 2014.
- [19] C.W. Ratnavathi, "Prospects of Sweet Sorghum as a Raw Material for Ethanol Production", *Perspective*, vol. 3 (3), pp. 1-3, 2018.
- [20] E. Noerhartati and T. Rahayuningsih, "Characterization of Sorghum Liquid Sugar", *JA*, vol. 7 (2), pp. 111-119, 2012.
- [21] E. Noerhartati and T. Rahayuningsih, "Liquid Sugar of Sorghum Stemp: A Study of Extraction Methods", Proceeding PERTETA UB Malang, pp. 60-67, 2012.
- [22] E. Noerhartati and T. Rahayuningsih, "Optimization of Sorghum Instant Noodles Products", Proceeding ISREM UWKS, pp. 50-57, 2015.
- [23] E. Noerhartati and T. Rahayuningsih, "Soft Bran of Sorghum Potential for High Fiber Supplement Food" Proceeding IFC UKWM Surabaya, pp. 131-137, 2016.
- [24] E. Noerhartati and T. Rahayuningsih, "Stick Sorghum (*Sorghum sp*) As Food Diversification Alternative Products", *JRP*, vol. 11 (2), pp. 38-44, 2017.
- [25] E. Noerhartati, T. Rahayuningsih, F.S. Rejeki, and E.R. Wedowati, "Activity Report of IbM Business Group Sorghum Syrup", UWKS, 2010.
- [26] E. Noerhartati, T. Widiartin, and N.W. Karsono, "Assorted Cakes Wet Sorghum" Research Report UWKS, 2015.
- [27] Wonojatun. "Formulasi dan Analisis Nilai Gizi Produk Mi Berbasis Sorgum". Skripsi. Institut Pertanian Bogor. Bogor. 2010.
- [28] E. Noerhartati, T. Widiartin, Maslihah, and N.W. Karsono, "Activity Report of IbIKK Production Center of Sorghum Product at UWKS Year 3", UWKS, 2018.
- [29] E. Noerhartati and F. Rizal. Phytochemical Screening Sorghum (*Sorghum sp*) Using Thin Layer Chromatography Method. Research Report UWKS, 2018.
- [30] E. Noerhartati, "Evaluation of Entrepreneurship Education on Development Program of Product Sorghum", *IJET*, vol. 7 (3), 30, pp. 400-404, 2018.
- [31] T. Widiartin and E. Noerhartati, "Build Sorghum Database for developing SEU digital network on sorghum website of Wijaya Kusuma Surabaya University" *IOP Conf Ser Mater Sci Eng*, vol. 434, p. 012253, 2018.
- [32] H.J. Kim, "Reconciling Entrepreneurial Orientation and Dynamic Capabilities: a Strategic Entrepreneurship Perspective", *JE*, vol. 27 (2), pp. 180-208, 2018.
- [33] E. Noerhartati, T. Widiartin, Maslihah, N.W. Karyanto, "The Development of Market Segmentation of Sorghum Products as Functional Beverages", *IOP Conf. Ser.: Mater. Sci. Eng. Vol. 434 (1)*, pp. 012169, 2018.
- [34] M.E. Agwu and H.N. Onwuegbuzie, "Effects of International Marketing Environments on Entrepreneurship Development". *JIE*, pp. 712, 2018.
- [35] E. Noerhartati. Building Entrepreneurship Networks Supporting Sorghum Development as Alternative Food. Proceeding of National Seminar of Dies Natalis, UWKS, pp. 39-48, 2017.
- [36] B. Tjahjono, C. Esplugues, E. Ares, G. Pelaez. "What does Industry 4.0 mean to Supply Chain?". *Manufacturing Engineering Society International Conference 2017, MESIC*. 2017.