

"Turtle Diagram" as a Tool of Forecasting in the Management of Production Risk in Agriculture - Literature Review

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Abstract

The "turtle diagram" is a well-known instrument in the theory of auditing and risk management. We will adapt this ISO-9001/2015 instrument to use it in forecasting production in agriculture, as one of the risk management tools in agricultural businesses. The sources of risks in agricultural businesses are numerous. To manage these resources in risk theory know several tools. These tools are: (i) Information; (ii) Forecast; (iii) Diversification; (iv) Excess capacity and reserves in inputs and output; (v) Lease agreements; (vi) Orders and contracts; (vii) Institutional instruments; (viii) Insurance; and (ix) Government.

The paper will focus on the "forecasting tool" in agricultural manufacturing businesses. This tool will be designed according to the "turtle diagram". This design visually combines factors, needs and outcome (production).

Keywords: diagram, risk, output, tool, specific, forecast.

1. Introduction

Risk management is vital and important for the success of agricultural businesses. Among the main risks faced by entrepreneurs of agricultural businesses is the risk of production. Agricultural producers are businesses that buy factors and turn them into results, hoping that their value is worth more than the total value of inputs. Some businesses, especially industrial ones, have the luxury of knowing exactly how much can be produced with a number of factors (Drollette, 2009). Producers in agriculture do not have that luxury. Agriculture is dangerous (Kahan, 2008: 10).

1.1 Specific risks

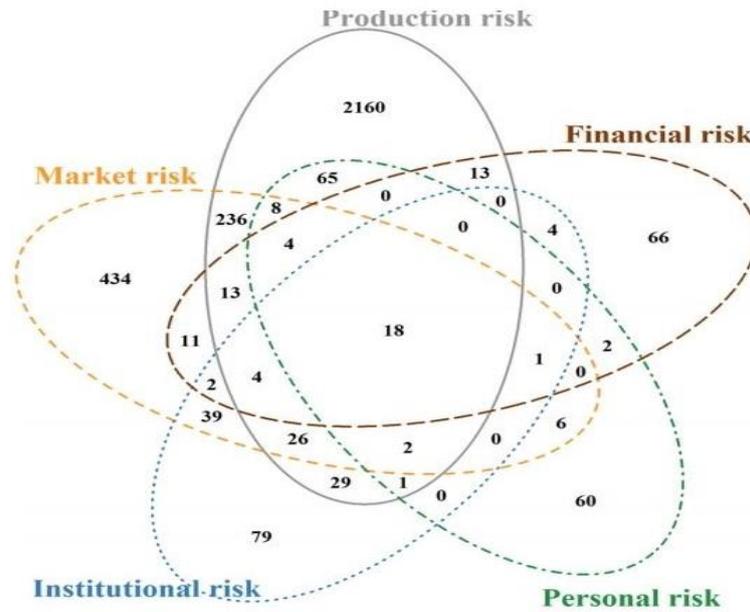
Risk management in agricultural businesses focuses on specific risks. Specific risks are: production risk, market risk, financial risk, legal risk and human resource risk (Kyna Kurtis; A.M. Turay; Kahan 2008; Crane et al., 2013).



Source: Presentation of the authors

Figure 1.1 Diagram of specific risk management in agricultural businesses

Komerak et al. (2020) have inventoried scientific articles on production risk, market risk, financial risk, legal risk, and human resource risk. In their study we find 2'160 articles on production risk; 434 market risk items; 79 articles on legal risk; 66 items on financial risk; and 60 articles on human resource risk. The distribution of the number of studies for the period 1974-2019 is presented in Figure 1.2 "Venn diagram" (Koremact., 2020).



Source: Komerak, De Pinto, Smith 2020:4.

Figure 1.2 Venn diagram for distribution of the number of studies across five types of risk between 1974 and 2019.

1.2 Sources of production risk in agriculture

Production is the main source of income in agriculture. It is therefore important for entrepreneurs

to recognize and manage production risk. Summary Table 1.1 presents all sources of negative risks and their exposure forms.

Table 1.1 Sources and forms of production risk

No.	Resources	Forms or types
1	Bad weather	Floods, droughts, frost, hail and wind.
2	Natural disasters	Earthquake, fire, landslide, etc.
3	Diseases	Plant and animal diseases.
4	Pests	Insect, flying, wildlife and weed.
5	Breakdowns in machinery and equipment	Old, co-owned, new but unqualified to use.
6	Health and well-being of the workforce	Older age, accident, illness and low family income.
7	Uncertainty of agriculture as a life science	Failure to discover cultivars and breeds of hybrids, pesticides and medicines.
8	Biological cycle	Biological cycle limitation, physiological maturity, commercial maturity, etc.
9	Market fluctuations	The increase of the price of the factors of production and the decrease of the price of production.
10	Globalization	Free trade agreement.

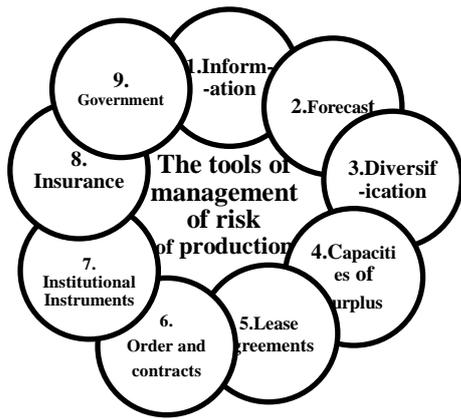
Source: Presentation of the authors

1.3 Production risk management tools in agriculture

We have many "tools" available to help farmers, agribusiness and agro-industry investors manage production risk. The use of risk management "tools" depends on the situation and ability. Knowledge and

understanding of "tools" help investors manage production risk.

The "tools" for managing production risk in agriculture are: Information; Forecast; Divesifikimi. Excess capacity and reserves in inputs and output; Lease agreements; Orders and contracts; Institutional instruments; Insurance and Government.



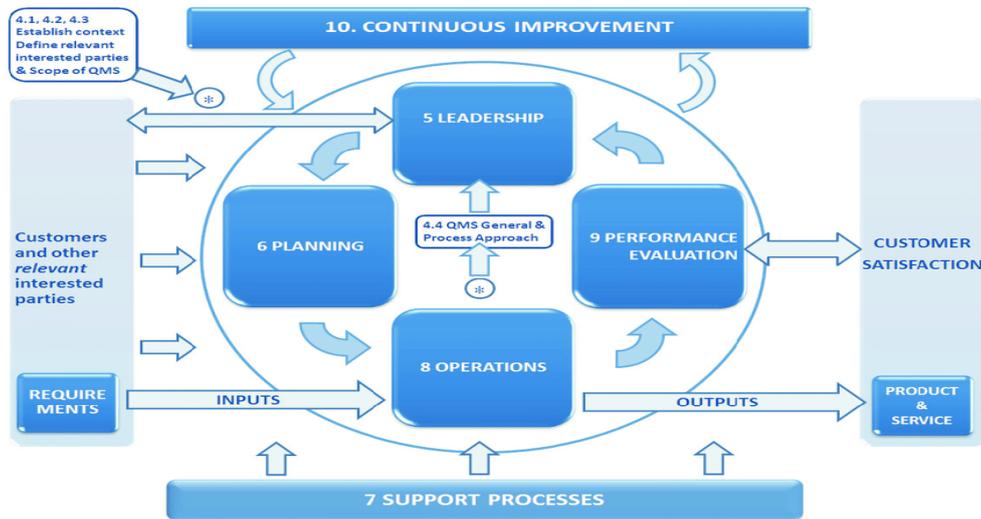
Source: Presentation of the authors

Figure 1.3 Production risk management tools in agriculture

Our study will analyze forecasting as one of the means of managing production risk. Production forecast will be schematized according to the "turtle diagram".

2. Literature Review

According to the ISO standard, the "turtle diagram" is a visual tool that shows all aspects of a process, including inputs, results, measurement criteria, and other important information that helps improve the efficiency of organizational processes. Regarding the use of the "turtle diagram" in audit and risk management processes, researchers point out its importance. According to Guo et al. (2019) the "turtle diagram" is used to control the quality of production and improve the economic benefits of enterprises, while Ruswanto and Saroso (2018) emphasize that using this diagram is performed risk analysis. Dementyev and Semenov (2017) take as a solution, the standard for vehicle manufacturers ISO 16949. The ISO 16949 approach to process description differs from that of ISO 9001; which focuses on the needs of the client, not the process itself. To implement this approach in utility companies it is proposed to use process processes "octopus" and "turtles". The octopus model takes into account eight factors (Pereira, Severo, and Fontoura 2012).



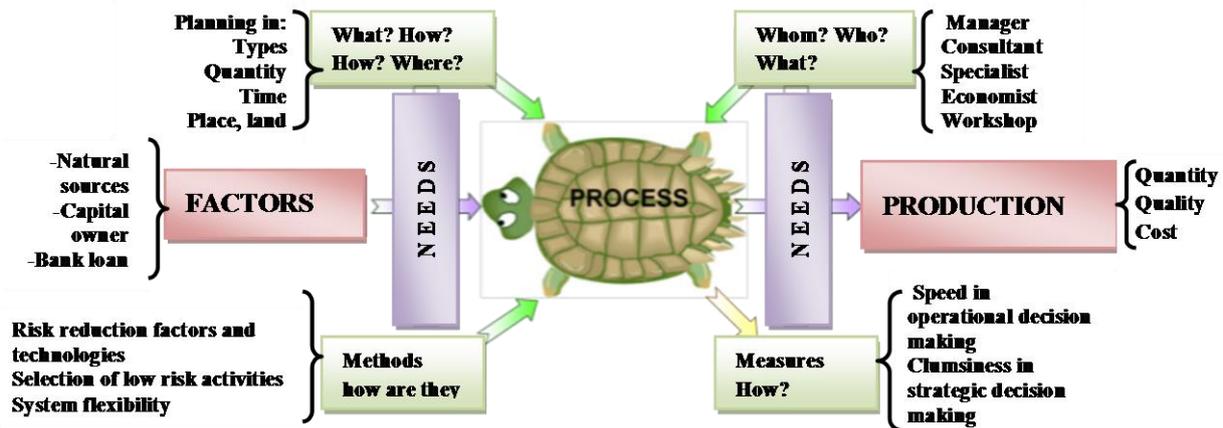
Source: Michael Abildgaard Pedersen, 2018:154

Figure 2.1 ISO 9001:2015-Model of a process-based quality management system, showing the links to the clauses of this International Standard

3. Results and Discussion

The "turtle diagram" displays the entire production forecasting process, as well as harmonizes the communication of the stages related to the respective

functions and levels within the agricultural business. The organization and operation of the "turtle diagram" is very simple. The diagram consists of six areas, which predict the production process, creating the image of the turtle body.



Source: Presentation of the authors

Figure 3.1 "Turtle diagram" as a forecasting tool in agricultural production

The areas are:

The first area in the center, on the left of the diagram, predicts the factors of production, which include: natural resources (climate, water, sun, agricultural land, pastures, forests, etc.); capital invested in agricultural business (cash, inventories, biological assets, machinery, equipment, etc.) and debts or loans taken by the business.

The second area at the top left of the diagram, predicts the plans, that: what, how much, how, where and when will we plant? Forecasts are detailed not only in the type of crops, trees, animals, birds; but also in quantities, days, weeks, months of the year and in the place and / or places where the business is located.

The third area at the bottom left of the diagram provides methods for selecting new factors and technologies to minimize risk; selection of low risk activities; and system flexibility.

The fourth area at the top right of the diagram, provides human resources for all production processes and business levels (managers, consultants, specialists, economists and workers).

The fifth area at the bottom right of the diagram predicts operational and strategic decision-making. Many agricultural production processes mature rapidly and require rapid decision-making, and some processes, such as buying long-term assets and obtaining long-term loans, require slower decision-making.

The sixth area in the center on the right predicts quantity, quality and cost of production. Getting predictable results means a good risk reward. The goal is to spend as little as possible to earn as much as possible.

4. Conclusions

Forecasting as a risk management tool is very complex. The "turtle diagram" is a convenient tool to predict in an agricultural businesses. Through it we

can reflect the characteristics of their process. The proper forecasting process to exchange is schematized according to the turtle body and the criteria, factors, results, etc. are easily identified. The diagram helps owners, investors and executives execute sales effectiveness that minimizes negative risks.

5. References

1. Abdullahi Hyssein, Kai Cheng (2017), "An Investigation on the Engineering Process Oriented Approach to Aerospace Quality Assurance Compliance in Manufacturing SMEs" pp. 456-458.
2. Adam M. Komarek, Alessandro De Pinto, Vincent H. Smith (2020), "A review of types of risks in agriculture: What we know and what we need to know" (<https://doi.org/10.1016/j.agsy.2019.102738>), pp. 4-7.
3. A.M. Turay (2015), "Agribusiness Risk & Risk Management: Taking Care of Business" <http://kysu.edu/ep-content/uploads/2015/11/Agribusiness-Risk-Management.pdf>, pp. 3-25.
4. Andrey S. Dementyev, Viktor P. Semenov (2017), "Implementation of the process approach used in the automotive industry based on ISO 16949 in service companies" DOI: 10.1109/EIConRus.2017.7910810, pp.1-10.
5. David Kahan (2013 reprint), *Managing risk in farming* E-ISBN 978-92-5-107544-9 (PDF), pp. 10-12.
6. Laurence Crane, Gene Gantz, Steve Isaacs, Doug Jose, Rod Sharp (2013), "Introduction to Risk Management"

- (<http://extensionrme.org/pubs/introductiontoriskmanagement.pdf>), pp. 8-15.
7. Hongfei Guo , Ru Zhang, Xiangyue Chen, ZhengëeiZouf, Ting Qu GuoquanHuanga,b, Jincheng Shi, Minshi Chen, Hao Gu, Yitao Lun, Jianke Li, Zhihui He (2019) **“Quality Control in Production Process of Product-Service System: a Method Based on Turtle Diagram and Evaluation Model”**; pp 390-393.
 8. Guilherme Vaz Pereira, Fabrício Severo, and Lisandra Fontoura (2012), **“A Risk Management Approach Based on Situational Method Engineering”**, pp. 3-4.
 9. Kisan Gunjal (2016) **Agricultural Risk Management Tools**, MODULE 3, pp. 11-113.
 10. Meço Maksim (2014) **“Drejtimi i Riskut të Biznesit”** pp. 25-125.
 11. Michael Abildgaard Pedersen, Copenhagen, Denmark (2018), **The Continuous Improvement Primer - an introduction to Basic Lean, Quality Management, Environmental Management and other Management Systems**, ISBN-10: 1985895722, pp. 154-167.
 12. Murrja Arif, Meço Maksim, Gentjan Mehmeti (2017) **“MenaxhimRisku”**.
 13. Murrja Arif (2020) **“Leksione të Menaxhimit të Riskut të Biznesit”**. Tema 8 “Menaxhimi i riskut te podhimit . (<https://sites.google.com/a/ubt.edu.al/arif-murrja/leksione>)
 14. Sarah A. Drollette (2009) **Managing Marketing Risk in Agriculture** (AG/ECON/2009-02RM) pp. 4-9.
 15. Tulus Puji Ruswanto, Dana Santoso Saroso (2018) **“Gap Analysis Study on the Compliance of Automotive Standard IATF 16949 based on Internal Quality Audit Score in Automotive Industry”**, J. Appl. Res. Ind. Eng. Vol. 5, No. 4 (2018) 271–285; pp. 278-279.
 16. <https://www.ers.usda.gov/topics/farm-practices-management/risk-management/risk-in-agriculture>
 17. <http://www.instat.gov.al/media/6190/indeksi-i-cmimeve-te-prodhimeve-bujqesore-2018.pdf>
 18. <https://16949store.com/articles/how-to-use-turtle-diagrams/>