RESEARCH OF FACTORS AFFECTING THE AGRO PRODUCTS LOGISTICS BASED ON THE AHP- GREY CORRELATION ANALYSIS
/
基于 AHP-灰关联分析法的农产品物流发展对策研究

Ph.D. Stud. Xu J., Prof. Ph.D. Yao G.
School of Business Administration, Jiangsu University / China
Tel: 0515-88168001; E-mail: gxyao@ujs.edu.cn

Abstract: *The long-standing problem of agricultural product logistics process heavy loss and high cost has seriously constrained the development of rural economy and the improvement of the living standard of farmers. In order to identify the main factors which influence the development of agricultural products logistics, six aspects, i.e. the rural logistics support level, the level of economic development, social attention, logistics supply and demand level, the level of modernization and logistics technical levels with 20 factors were selected to establish evaluation index system. The combination of analytic hierarchy process and Grey correlation analysis method is applied to calculate the indicators at all levels. And the results were analyzed meticulously with a view to China's modern agricultural product logistics development planning and provide scientific basis.*

Keywords: *agro products logistics, index system, AHP, Grey correlation analysis.*

INTRODUCTION

After years of development, the supply and output capacity of agricultural products in China has made great improvement. But compared to the United States and other developed countries, there is still a large gap. A prominent problem is the process of agricultural logistics losses and the high cost of circulation. According to the data, the loss rate of fruits, vegetables and other agricultural products in developed countries in the harvesting, transport and storage process is less than 5%, while China's loss rate is about 35%, even in the developed areas in China, the loss rate can also reach 20% to 30%[1]. At the same time, as a large agricultural country, the liquidity of China's agricultural products, food, oil, vegetables, fruit, meat, eggs and other products ranked first for many years, in the world. The high loss rate as well as a huge base led to a serious waste of China's agricultural intermediate links. In view of this, the domestic scholars have carried out extensive research around the impact of China's agricultural products logistics problem. Yang Jun, et.al[2] measured the logistics efficiency of agricultural products of China's major provinces over the years with distance function and non-parametric linear programming method, proving that rural urbanization in China has a significant role to enhance the efficiency of agricultural logistics. Li Qingfang[3] identified the six key factors like the total power of agricultural machinery, the state of financial expenditure for agriculture that affect the demand for agricultural products logistics with multiple linear regression and principal component analysis method, and established a linear regression model. Taking vegetables liquidity for instance, Tang Bulong[4] analyzed the effect of roads, the level of information, brokers, facilities, and education level on logistics development, and came to the level of significance of each factor. It is not difficult to find that the studies above are more in-depth studies selecting only one aspect of China's agricultural products logistics. A comprehensive analysis of the influencing factors of China's agricultural products logistics is

摘要: *为了找出影响农产品物流发展的主要因素，选取了农村物流支持水平、经济发展水平、社会关注度、物流供需水平、现代化水平和物流技术水平等几个方面建立评价指标体系，运用层次分析与灰关联分析相结合的方法，计算出了各级指标的最终权重。计算结果表明我国的物流技术水平、基础设施建设、社会对农产品物流的关注度、农村机械化水平以及互联网的普及程度等仍然偏低，并针对这些问题提出了相应的对策与建议。*

关键词: *农产品物流, 指标体系, 层次分析法, 灰关联分析法*

引言

经过多年的发展，我国的农产品供给及输出能力取得了较大的提高，但是相较于美国等发达国家，仍存在较大的差距。其中一个突出的问题就是农产品物流过程损耗大、流通成本高。数据显示，发达国家水果蔬菜等农副产品在采摘、运输、储存的过程中损失率不到 5%，而我国农产品在物流中的损耗率达到 35%左右，即使在发达地区，其损耗率也达到了 20% ~ 30%[1]。与此同时，作为一个农业大国，我国农产品流通量大，粮食、油料、蔬菜、水果、肉蛋等产品产量连续多年居世界第一，较高的损失率以及巨大的基数导致了我国农产品中间环节浪费严重。鉴于此，国内学者围绕影响我国农产品物流的相关问题展开了广泛的研究。杨军、王厚俊[2]等采用距离函数和非参数线性规划的方法测量了我国主要省份历年的农产品物流效率，通过实证研究发现我国农村城镇化对农产品物流效率的提升具有明显的促进作用。李庆芳[3]通过多元线性回归及主成分分析等方法找出了影响农产品物流需求的农业机械总动力、农林牧渔业总产值、国家财政用于农业的支出等 6 个关键因素，并建立了一次线性回归模型。唐步龙[4]以蔬菜流通量为例，在对淮安、宿迁等 13 个县区面板数据进行搜集整理的基础上，分析了道路、信息化水平、经纪人队伍、设施及教育水平对物流发展的影响，并得出了各影响因素的显著性水平。不难发现，以上研究都较深入，但选取的研究对象都只反映了我国农产品物流的某个方面，尚未开始全面地分析我国农产品物流的影响因素。因此，对影响农产

still in short. Therefore, a comprehensive analysis to identify the key and targeted factors to improve them is with practical significance.

The main factors affecting the agricultural product logistics

There are many factors affecting agricultural products logistics. Yang, Tang as well as Li gave a detailed study from the agricultural logistics point of view. In addition, Feng Dan[5] carried out a detailed analysis by selecting the four aspects of a total of 17 factors from the perspective of the logistics industry as a whole. After earnestly drawing, six aspects including rural logistics support level, the level of economic development, social attention, supply and demand level of logistics, the level of modernization and logistics technology of a total of 20 factors affecting the agricultural product logistics are filtered on this basis, combined with expert advice.

品物流的主要因素进行分析，找出其中的关键因素，并进行针对性地改善就具有较大的现实意义。

影响农产品物流的主要因素

影响农产品物流的因素众多，杨军、唐步龙以及李庆芳等都从农产品物流角度给出了详细的研究，此外冯丹[5]等人还从物流业整体发展的角度选取了四个方面的共 17 个因素进行了详细的分析。本文经过认真汲取，结合专家意见，在此基础上经过筛选，认为影响农产品物流的主要因素包括农村物流支持水平、经济发展水平、社会关注度、物流供需水平、现代化水平和物流技术水平等六个方面共 20 个因素，建立评价指标体系如表 1 所示：

Table 1 / *表 1*

Agri-product logistics development level evaluation index system / 农产品物流发展评价指标体系

The first grade indexes(A) / 一级指标 A	The second grade indexes (B) / 二级指标 B	Weights / 权重	The third grade indexes(C) / 三级指标 C	General ranking / 总排序
Agricultural Product Logistics / 农产品物流	The rural logistics support level / 农村物流支持水平	0.1373	The length of rural postal line / 农村邮递线路长度	0.0318
			The number of employees of the transportation and warehousing industry / 交通运输仓储业从业人员数	0.0319
			The total power of agricultural machinery / 农业机械总动力	0.0379
			National fiscal expenditure for agriculture / 国家财政用于农业的支出	0.0305
			The original value of fixed assets for production of rural households(transportation, post and telecommunications) / 农村家庭生产性固定资产原值（交通运输邮电业）	0.0422
			Fixed asset investment in rural areas / 农村固定资产投资	0.0337
	The level of economic development / 经济发展水平	0.2452	Per capita net income in rural areas / 农村人均纯收入	0.0818
			Retail sales in rural areas / 农村社会消费品零售总额	0.0646
			Per capita gross domestic product / 人均 GDP	0.0761
			Urbanization rate / 城镇化率	0.0595
	Social attention / 社会关注度	0.0314	The number of articles of the rural logistics phase in CNKI / CNKI 中农产品物流相关文章数量	0.0071
	Logistics supply and demand levels / 物流供需水平	0.2345	The number of import and export of agricultural products / 进出口农产品数量	0.0553
			Agriculture, forestry, animal husbandry and fishery 农林牧渔业总产值	0.0801
	The level of modernization / 现代化水平	0.1130	Overall netizens / 总体网民规模	0.0232
			Internet penetration in rural areas / 农村互联网普及率	0.0188
			The extent of resident education / 居民受教育程度	0.0347
	The level of logistics technology / 物流技术水平	0.2385	The level of storage technology / 仓储技术水平	0.0712
			The technical level of the fresh frozen technology / 冷冻保鲜技术水平	0.0649
			The level of packaging technology / 包装技术水平	0.0661
			The level of picking technology / 采摘技术水平	0.0655

MATERIAL AND METHOD

Calculation of qualitative indicators

As the level of development of the agricultural product logistics evaluation is a complex multi-factor integrated decision with incomplete information, which contains both qualitative indicators and quantitative indicators. Among the index factor is essentially a gray relationship. So it is to be calculated with the combined method of AHP and gray relational analysis. Analytic Hierarchy Process is a method that decomposes decision-making related elements and combines each attribute on a qualitative judgment and quantitative analysis by constructing a hierarchy and ratio analysis. It can be divided into six steps, such as define the problem, establish hierarchy, build judgments matrix, hierarchy single ranking and its uniformity inspection, hierarchy general ranking, uniformity inspection. According to the judgment matrix, A B layer level single-sort results are calculated as follows. In Table 2, $\lambda_{\max}=6.1269$, $CI=0.0254$, $RI=1.24$, the mean random consistency index $CR=0.0205<0.10$.

计算方法

定性指标的计算

由于农产品物流发展水平评价是一个信息不完全的复杂多因素综合决策问题，评价指标中既有定性指标，也包含定量指标，各指标因素之间本质上是一种灰色关系，故采用 AHP 与灰关联分析相结合的方法进行计算。其中，层次分析法是将与决策有关的元素分解，通过构造层次结构和比率分析将各属性上的定性判断与定量分析结合起来[6]。大体分为六个步骤，即明确问题；建立层次结构；构造判断矩阵；层次单排序及其一致性检验；层次总排序；最后做出相应决策。根据专家填写的判断矩阵，计算出 A 对 B 层的层次单排序结果为表 2 所示。其中 $\lambda_{\max}=6.1269$，$CI=0.0254$，$RI=1.24$，平均随机一致性指标 $CR=0.0205<0.10$。

Table 2 /*表 2*

Secondary indicators of single-level sequencing / *二级指标层次单排序*

The second grade indexes / *二级指标 B*	Weights(b_i) / *重要度 b_i*
The rural logistics support level / *农村物流支持水平*	0.1373
The level of economic development / *经济发展水平*	0.2452
Social attention / *社会关注度*	0.0314
Logistics supply and demand levels / *物流供需水平*	0.2345
The level of modernization / *现代化水平*	0.1130
The level of logistics technology / *物流技术水平*	0.2385

Calculation of quantitative indicators

Professor Deng Julong's system theory is a mathematical method used to solve the system of uncertain information. The basic idea of the theory is analyzing the degree of association or similarity between various elements in the system and upon which the system is sorted. The advantage of this method is a comparison of the geometric relationship of the system within the time sequence statistics can be conducted for multiple indicators by a quantitative analysis of the development trend of the dynamic process. And thus the gray relational degree between the reference series and comparing columns can be obtained. It avoids accidental impact of a given year data, and the data requirements are not demanding. During the Grey correlation calculations, expert opinion method is used to rate the qualitative indicators. Then associate the B layer index with the C layer index calculated by multiplying the weights and its correlation. The impact of the second indicators can also be taken into account in the calculation of gray relational analysis with the combination of AHP and Grey Relational Analysis, so that the computing is closer to reality. The specific calculation steps

定量指标的计算.

邓聚龙教授所提出的灰色系统理论是用来解决信息不确定系统的一种数学方法，其基本思想是通过分析系统中各元素之间的关联程度或相似程度，依据关联度对系统排序。该方法的优点就是可以针对多个指标，通过对动态过程发展态势的量化分析，完成对系统内时间序列有关统计数据几何关系的比较，从而求出参考数列与各比较数列之间的灰关联度，避免了某一年数据的偶然性影响，对数据要求不苛刻。在进行灰关联计算时，采用专家意见法对定性指标进行评分。然后将 B 层指标的权重与灰关联计算出的 C 层指标关联度相乘。将 AHP 法与灰关联分析相结合可以将二级指标的影响程度也考虑到灰关联分析的计算中，从而使计算更加接近现实，其具体计算步骤为：

are as follows:

- Determine the analysis of the number of columns. Setting the reference sequence is $Y=\{Y(k)\mid k=1,2,\Lambda,n\}$; the comparative sequence is $X_i=\{X_i(k)\mid k=1,2,\Lambda,n\},i=1,2,\Lambda,m$. The amount of agricultural product logistics from the year 2005 to 2010 is selected as the reference sequence, which is regarded as a substitute for the overall level of development of the agricultural products logistics.
- Standardized processing of the index value. In this paper, the mean law is used to regulate the treatment, and eliminate the dimensionless impact of different indicators to get a matrix $x=x_i(k),k=1,2,\Lambda,n;i=1,2,\Lambda,m$;
- The calculation of the correlation coefficient. For the reference sequence and comparative sequence, the points to the interval distance method are used to obtain the correlation coefficient of the $Y(k)$ and $x_i(k)$:

- 确定分析数列，设参考序列 $Y=\{Y(k)\mid k=1,2,\Lambda,n\}$; 比较序列 $X_i=\{X_i(k)\mid k=1,2,\Lambda,n\},i=1,2,\Lambda,m$。文中选择的参考序列为 2005-2010 年的农产品物流量，以此代替农产品物流发展的总体水平。
- 指标值的规范化处理。本文采用均值法进行规范处理，消除不同指标之间的量纲影响，得到矩阵 $x=x_i(k),k=1,2,\Lambda,n;i=1,2,\Lambda,m$；
- 计算关联系数。对于参考序列和比较序列，采用点到区间距离的方法求得 $Y(k)$ 与 $x_i(k)$ 的关联系数：

$$\xi_i^{\,k}=\frac{\min\limits_i\min\limits_j|Y_i(k)-x_i(k)|+\rho\max\limits_i\max\limits_j|Y(k)-x_i(k)|}{|Y(k)-x_i(k)|+\rho\max\limits_i\max\limits_j|Y(k)-x_i(k)|} \tag{1}$$

In the formula, ρ is the distinguishing coefficient. The smaller the ρ whose argument is in the interval (0, 1), the greater the resolution is. Usually ρ=0.5. As the degree of correlation between the comparative sequence and the reference sequence, the associated formula of the k factor is:

式（1）中，ρ 为分辨系数。ρ 越小，分辨力越大，一般其取值区间为（0,1），通常取 ρ=0.5。则作为比较数列与参考数列间关联程度的数量表示，第 k 个因素关联度公式为：

$$C_i(k)=\frac{\xi_i^{\,k}}{\sum_{k=1}^{n}\xi_i^{\,k}} \tag{2}$$

The general ranking $W=\sum_{j=1}^{3}b_jc_i(k)\,i=1,2,3,4,5,6)$. The calculation results are shown in Table 4 for the quantitative indicators.

计算总排序结果。总排序 The general ranking $W=\sum_{j=1}^{3}b_jc_i(k)\,i=1,2,3,4,5,6)$.对于上述定量指标的计算结果见表 3。

Table 3 /表 3

The Grey relational sort results / *灰关联排序结果*

The third grade indexes / *三级指标*	**correlation degree(c_{ij}) / *关联度***
The length of rural postal line / *农村邮递线路长度*	0.0913
The number of employees of the transportation and warehousing industry / *交通运输仓储业从业人员数*	0.0915
The total power of agricultural machinery / *农业机械总动力*	0.1087
National fiscal expenditure for agriculture / *国家财政用于农业的支出*	0.0874
The original value of fixed assets for production of rural households(transportation, post and telecommunications) / *农村家庭生产性固定资产原值（交通运输邮电业）*	0.1211
Fixed asset investment in rural areas / *农村固定资产投资*	0.0967
Per capita net income in rural areas / *农村人均纯收入*	0.2348
Retail sales in rural areas / *农村社会消费品零售总额*	0.1853
Per capita gross domestic product / *人均GDP*	0.2184

Urbanization rate / *城镇化率*	0.1706
The number of articles of the rural logistics phase in CNKI / *CNKI 中农产品物流相关文章数量*	0.0205
The number of import and export of agricultural products / *进出口农产品数量*	0.1587
Agriculture, forestry, animal husbandry and fishery / *农林牧渔业总产值*	0.2299
Overall netizens / *总体网民规模*	0.0665
Internet penetration in rural areas / *农村互联网普及率*	0.0540
The extent of resident education / *居民受教育程度*	0.0995
The level of storage technology / *仓储技术水平*	0.2044
The technical level of the fresh frozen / *冷冻保鲜技术水平*	0.1863
The level of packaging technology / *包装技术水平*	0.1897
The level of picking technology / *采摘技术水平*	0.1878

In the difference sequence Min=0.0007, Max=0.6062.

RESULTS

After calculation, the final result for each index is shown in Table 1, from which we can see the macro-economic indicators such as per capita net income in rural areas, per capita GDP, has a greater impact on the agricultural products logistics of the year 2005 to 2010. Then , the retail sales in rural areas, The level of logistics technology, urbanization rate, the number of import and export of agricultural products etc, which can be regarded as factors affecting the consumption. Followed again , the technical level of the fresh froze, the original value of fixed assets for production of rural households, the total power of agricultural machinery, fixed asset investment in rural areas etc, which can be viewed as agricultural impact factors and key technical factors. Finally, other factors are considered, the effect of which in the years 2005-2010 on China's total agricultural product logistics is very small.

CONCLUSIONS

It can be seen that with the national increase of agricultural inputs and financial support to the agriculture, forestry, animal husbandry and fishery output value constraints to the amount of agricultural products logistics has been gradually reduced, based on the analysis above, combined with the current situation of China's agricultural products logistics. In order to improve the overall level of development of the agricultural product logistics, the government should focus on improving the level of infrastructure and agricultural mechanization, level of modernization of rural logistics information, as well as agricultural products logistics technology and other related aspects.

Continuous increasing of rural logistics infrastructure

For a long time, China's road infrastructure, means of transport were relatively undevelopped[7], which demonstrates mainly in the small scale of road network, low homeland coverage and road grade, as well as poor capacity. The volume of rural transport is small. Part of the

在求差序列中， Min=0.0007，Max=0.6062。

计算结果

经过计算，各指标的最终结果如表 1 所示，从表 1 中可以看出，在各影响因素中农民人均纯收入、农林牧渔业总产值以及人均国内生产总值等描述宏观经济总框的指标对 2005-2010 年的农产品物流总额影响最大；其次是农村社会消费品零售总额、农产品物流技术水平、城镇化率、进出口农产品数量等，可视为消费影响因素；再次是农产品冷冻保鲜技术水平、交通运输邮电业农村家庭生产性固定资产原值、农业机械总动力、农村固定资产投资、交通运输仓储业从业人员数、农村邮递线路长度、国家财政用于农业的支出等，可视为农业影响因素及关键技术因素；最后是其他因素，在 2005-2010 年我国农产品物流总额的影响中所占比重甚轻。

结论与建议

根据以上分析，结合我国的农产品物流现状可以看出，随着国家对农业投入及财政支持力度的加大，农林牧渔业总产值等因素对农产品物流量的制约已经逐渐减小。为了提高农产品物流的总体发展水平，应着重从提高基础设施水平和农业机械化水平、农村物流信息现代化水平、以及农产品物流技术水平等相关方面着手。

继续加大农村物流基础设施建设

长期以来，我国的道路基础设施、运输工具都比较落后[7]，主要表现在公路网规模小、国土覆盖率低、公路等级低、通行能力差等几个方面。农村的运输工具运量小、集约

backward areas still maintain the traditional rough mode of transport as the main means of transport, such as agricultural vehicles or small and medium-sized trucks, even with the help of human or animal power, which contributes to transportation inefficiencies, high energy consumption and heavy pollution. Therefore, to promote the development of agricultural product logistics, we must continue to increase the logistics infrastructure in rural areas, improve the level and coverage of rural roads, and increase the investment in fixed assets of the transportation of Posts and Telecommunications industry for production of rural households.

Gradually increase the rate of agricultural mechanization

It is an important indicator of agricultural mechanization to measure a country's level of agricultural development. In the early 1940s, the United States took the lead in realizing the mechanization of food production. Since the 1990s, food, crops and some vegetables of developed countries led by the United States have achieved a high degree of mechanization from planting to harvest. The substantial decline in the proportion of the agricultural labor force, accounts for only 2% to 8% of the country's total labor force. Although many developing countries, including China, have accelerated the pace of agricultural mechanization, overall it is still only equivalent to the level of economically developed countries in the early 1950s to 1960s. It is also very important for the promotion of agricultural development and agricultural logistics to increase the level of agricultural mechanization, and vigorously raise cropland efficiency as well as labor transfer.

Promote the construction of agricultural information

At present, information of agricultural products is mainly released through radio, television and other traditional media in China. With the rapid development of information technology, the information center of rural economy and agricultural professional websites have been built[9]. There are some rural agricultural leading enterprises which establish a specialized agricultural products page website publishing market information and gaining agricultural publicity. But overall, the level of information construction in rural areas is still rather backward with low Internet penetration and poor information flow. The level of agricultural e-commerce has yet to be enhanced.

Increasing the degree of social wide concern

In recent years, with the concern of three rural issues, agricultural products logistics began to attract attention of the community. More and more in-depth studies are carried out by experts and scholars in this field. However, these are still far unable to meet the needs of the development of rural logistics. First, it is the lack of professional logistics of company stationed in the logistics market of agricultural products. Second, the lack of government attention and great support for agricultural products logistics enterprises. As a result, it needs not only the government, the media, the attention of the relevant agencies, but also the 3PL enterprises and strong preferential policies to increase social concern ai a wide range.

Developing modern logistics technology

Because of the fresh and perishable nature of some agricultural products, their preservation time is short with demanding storage environment and conditions, which makes such agricultural products logistics cost, low efficiency, and lack of profitability point[10,11]. Therefore, in

性差，部分落后地区仍保持传统粗犷的运输方式，以农用车辆或中小型卡车作为主要运输工具甚至借助人力或畜力，运输效率低下、能耗高且污染重。因此，促进农产品物流的发展，必须继续加大农村物流基础设施建设，提高农村道路等级及覆盖率，增加交通运输邮电业农村家庭生产性固定资产投资。

逐步提高农业机械化率

农业机械化水平是衡量一个国家农业发展水平的重要标志。20 世纪 40 年代初，美国率先实现了粮食生产的机械化。从 90 年代开始，以美国为首的发达国家粮食、经济作物以及部分蔬菜从种植到收获都实现了高度的机械化，农业劳动力的比例大幅下降，只占到全国总劳动人口的 2%-8%。而虽然包括中国在内的许多发展中国家也一直在加快农业机械化步伐，但总体看来，仍只相当于经济发达国家 50-60 年代初期的水平[8]，农机化水平远远落后与发达国家。提高农业机械化水平，大力提高耕地效率以及劳动力转移，对于促进农业发展、农产品物流的进步也十分重要。

促进农业信息化建设

目前，我国主要通过广播、电视等传统媒体发布农产品信息，随着信息化的迅速发展，各种农村经济信息中心和农业专业性网站相继建成[9]，也有一些农村农业龙头企业建立了专门的农产品网页网站，发布市场信息以及进行农产品的宣传等。但是总体看来，农村信息化建设水平仍然相当落后，互联网的普及率低、信息流通度差，农产品电子商务水平仍有待增强。

广泛增加社会关注度

近年来，随着国家对三农问题的重视，农产品物流也开始逐渐受到社会各界的关注，不少专家学者对该领域的研究也越来越深入，但是这些仍远远无法满足农村物流发展的需要。首先是缺乏专业的物流公司进驻农产品物流市场，其次是缺乏政府对农产品物流企业的关注与大力扶持。因此，广泛增加社会关注度，不仅需要政府、媒体、相关机构的重视，更需要 3PL 企业以及强有力的优惠吸引政策。

发展现代物流技术

由于部分农产品具有鲜活与易腐特性，保鲜时间短，储存环境与条件要求苛刻，使得该类农产品的物流配送成本高、效率低，缺乏盈利点[10，11]。因此在农产品生产、运

the entire chain of agricultural production, transportation and sales, technological innovation has become an important support and motivation of the development of agricultural products logistics industry[12]. The United States with developed agricultural logistics has formed a modern logistics technology system with IT having as core, storage and transportation technology , packaging technology and other professional technology as the support[7,13]. While in China's agricultural technology research and development emphasis is generally placed on the technology of the production processes in the fields, such as seed and plant protection, then gradually starting to focus on the aspects of technical research of the processing of agricultural products. Also, technology research of agricultural products logistics chain has not been taken seriously[14]. Backward logistics technology seriously hindered the development of China's agricultural products logistics, causing waste and loss of agricultural custody and transit. Therefore, to develop modern agricultural products logistics technology, including picking, warehousing and packaging, to guide agricultural products logistics standardization have an important significance to promote the progress of agricultural products logistics, develop rural economic and increase farmers' income.

Aknowlegement

This work was supported by Graduate Innovation Project fund of Jiangsu Province –CXLX12_0681

REFERENCES

[1]. Yang J., Ge F. (2011) – *The Financial Support Policy of the Construction and Operation of the Modern Logistics System of Agricultural product*, Ecological Economy, no. 3;

[2]. Yang J., Wang H. (2011) – *Effects of China's urbanization on agricultural products logistics efficiency*, Journal of Agro technical Economics;

[3]. Li Qingfang. (2011) – *Factors influencing logistics demand of agricultural products*, China Business & Trade, no.7;

[4]. Tang Bulong. (2009) – *Panel Data-Based Vegetables liquidity impact factors Research*, Statistics and Decision, no.22;

[5]. Feng Dan. (2012) – *A Case Study of Gansu Province based on Grey's theory analysis of factors affecting the development of logistics*, Productivity Research;

[6]. Yao G., Liu L. (2011) – *F-AHP-Based Partner Selection in Dynamic Alliance of Distribution Centers*, Industrial Engineering;

[7]. Liu W.. (2011) – *Development of the agro logistics of international experience and inspiration*, Agro economics, no.9;

[8]. Chen R., Liu Ch. (2011) – *Present Growth in China's Agricultural Mechanization and Its Development Trend*, Agricultural Science & Technology and Equipment, vol.8, no.8;

[9]. Liu Y. (2011) – *Agro Product Logistics Development Strategies in the Context of Globalization*, Macroeconomic Management, no.11;

[10]. Liang W., Hou Y. , Ge R. (2012) – *China's net purchases of agricultural products analysis*, Issues in Agricultural Economy, no.4;

[11]. Zhao P. , Luo Yi. (2011) – *Case Study on Agriculture E-commerce in China* [J] Journal of Business Economics, vol.7, no.7;

[12]. Chen R., Wu J. (2005) – *On the Countermeasures of our Third Party's Interflow of Commodities Development*, Journal of Anhui University of Technology (Social Sciences), vol. 9,no.5;

[13]. Tao J., Chu Y. (2010) – *U S. Agro Logistics Research,Commercial Times*, no.4;

输、销售的整个链条上，技术创新就成为了农产品物流产业发展的重要支撑和动力[12]。农产品物流发达的美国已经形成了以信息技术为核心、以储运技术和包装技术等专业技术为支撑的现代化物流技术体系[7,13]。而在我国以往的农业技术研发中，一般比较重视良种、植保等田间地头生产环节的技术研究，后来逐渐开始重视农产品加工环节的技术研究，而农产品物流环节的技术研究却一直没有受到重视[14]。物流技术的落后严重束缚了我国农产品物流的发展[15]，造成了农产品保管以及运输途中的浪费和损耗。因此，发展包括采摘、仓储、包装等在内的现代农产品物流技术，引导农产品物流标准化对于促进农产品物流的进步、农村经济发展以及农民增收具有重要意义。

Aknowlegement

江苏省研究生创新项目（CXLX12_0681）

参考文献

[1]. 杨军，葛孚桥. (2011) – 现代农产品物流体系建设与运行的财政支持政策探讨，生态经济，第 3 期 ；

[2]. 杨军，王厚俊. (2011) – 我国城镇化对农产品物流效率的影响[J]农业技术经济，第 10 期；

[3]李庆芳. (2011) – 农产品物流需求的影响因素研究，中国商贸，第 7 期；

[4]. 唐步龙. (2009) – 基于 Panel Data 的蔬菜流通量影响因素研究，统计与决策，第 22 期；

[5]. 姚冠新，刘玲玲. (2011) – 基于 F-AHP 的配送中心动态联盟伙伴选择研究，工业工程，第 2 期；

[6]. 刘文涛. (2011) – 发展农产品物流的国际经验及启示，农业经济，第 9 期；

[7]. 程睿，刘春旭. (2011) – 我国农业机械化发展现状及展望，农业科技与装备，第 8 卷，第 8 期；

[8]. 刘同利. (2011) – 全球化背景下农产品物流发展对策，宏观经济管理，第 11 期；

[9]. 梁文卓，侯云先，葛冉. (2012) – 我国网购农产品特征分析[J]农业经济问题，第 4 期；

[10]. 赵苹，骆毅. (2011) – 发展农产品电子商务的案例分析与启示[J]商业经济与管理，第 7 卷，第 7 期；

[11]. 杨芳. (2011) – 生鲜农产品供应链管理研究综述及展望，物流工程与管理，第 7 期；

[12]. 陈荣，吴金南. (2005) – 我国第三方物流业发展的对策，安徽工业大学学报(社会科学版)，第 9 卷，第 5 期；

[13] 陶君成,初叶萍. (2011) – 美国农产品物流研究述评，商业时代，第 4 期；

[14]. Hu X. (2010) – *The Construction of the Support System for Modern Agricultural Products Logistics Industry Development*, China Business and Market, no.5;
[15] Li L., Deng B. (2010) – *Research on the Application of Circulation Technology in Wholesale Market of Agricultural Products in China*, Journal of Beijing Technology and Business University (Social Science), vol.11, no. 6.

[14]. 胡星辉. (2010) – 农产品现代物流产业发展的支撑体系构筑，中国流通经济，第 5 期。
[15]. 李丽，邓博文. (2010) –流通技术在我国农产品批发市场中的应用研究，北京工商大学学报（社会科学版），第 6 期。