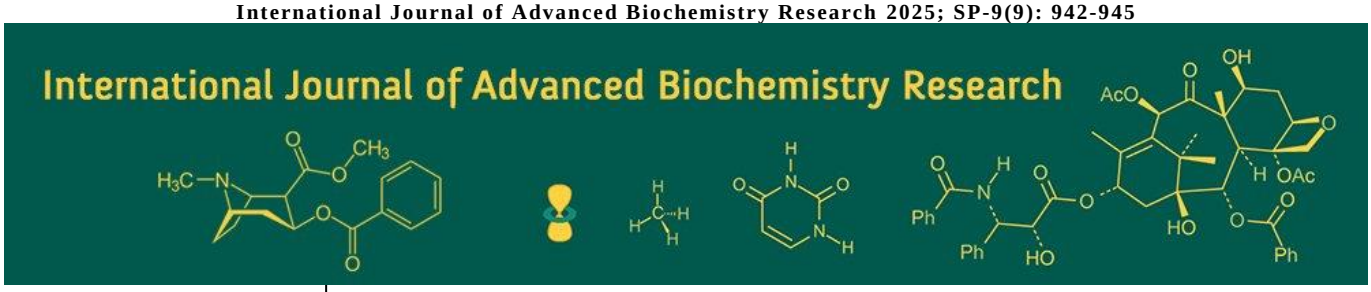

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Determinants of technological and yield gaps among onion growers in Chitradurga district

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Abstract
As a staple in kitchens and a key contributor to India's agricultural economy, onion holds a dual role supporting food security and generating export earnings. India is the world's second largest onion producer, with Karnataka ranking among the leading states within state Chitradurga district has become a vital onion growing region. Yet, despite its prominence, onion cultivation here is constrained by technological and yield gaps that limit productivity and profitability. Against this backdrop, the present study was undertaken to analyze the association between independent variables and the technological as well as yield gaps of onion growers. An ex-post facto research design was employed and 120 farmers were selected from major onion growing villages in the district. Data were gathered using structured questionnaires and chi-square tests were applied to examine associations between independent variables and the observed gaps. Findings revealed that education, annual income, knowledge, risk orientation, innovativeness, scientific orientation, market orientation and mass media exposure were significantly associated with technological gaps at the 5 percent level, while farming experience, extension contact and extension participation showed significant associations at the 1 percent level. Age and family size, however, exhibited no association. A similar pattern was observed with yield gaps, where most socio-economic and behavioural factors were significant at the 5 percent level, while farming experience, extension contact, and extension participation were highly significant at the 1 percent level. Age and family size were again unrelated. The study highlights the importance of socio-economic and behavioural variables in shaping technological and yield gaps. Strengthening extension networks, fostering market orientation, and promoting innovative and scientific practices among onion growers can help bridge these gaps and enhance the productivity and profitability of onion cultivation.

Keywords: Onion cultivation, technological gap, yield gap, socio-economic factors, extension services

Introduction
Onion (*Allium cepa* L.), popularly known as *Earulli*, *Ullagaddi*, *Piyaz*, *Palandu* and *Kanda*, occupies a unique place in Indian agriculture as both a staple food ingredient and a cash crop. Often referred to as the "Queen of Kitchen" in Germany, onion is indispensable in culinary practices worldwide, being consumed in both green and mature stages across diverse cuisines. India, the world's second largest producer of onions, contributes nearly 23 percent to global production and stands first in acreage. During 2021-22, onion was cultivated on 19.41 million hectares with a production of 31.68 million metric tons, positioning Maharashtra as the leading producer, closely followed by Karnataka. Within Karnataka, Chitradurga district ranks second after Vijayapura, contributing substantially to the state's onion production across all three seasons, with *kharif* cultivation being most dominant. Despite this prominence, onion farming continues to be constrained by several challenges. Farmers face acute market price fluctuations, poor storage infrastructure, dependence on middlemen and mounting financial pressures that force distress sales immediately after harvest. These issues result in decreased profitability for farmers and recurring dissatisfaction for consumers due to unstable supply and price volatility. Although considerable efforts have been made by researchers and extension organizations to promote improved technologies, adoption of scientific cultivation practices remains limited. The reliance on traditional methods, local varieties and lack of adequate support services further widens the gap between potential and actual yields.

In this context, understanding the technological and yield gaps becomes crucial, as they directly influence productivity and farmers income. Identifying the socio economic and behavioural factors associated with these gaps helps in developing strategies to enhance adoption of scientific practices and improve productivity in onion cultivation. Therefore, the present study was undertaken in Chitradurga district to analyze the association between independent variables and the technological as well as yield gaps of onion growers, thereby providing insights into measures for bridging these gaps and strengthening farmers' livelihoods.

Methodology

An *ex-post facto* research design was adopted for the present investigation. This design is particularly suitable when the independent variables under study cannot be manipulated, as they have already occurred or are inherent in nature. Chitradurga district of Karnataka, being one of the leading onion-producing regions of the state, was purposively selected. Within the district, Challakere and Hiriyur taluks were chosen, as they record the highest onion production and acreage. From each taluk, six major onion growing villages were identified. A stratified approach was used. From each selected village five small and five big onion growers were randomly selected. Thus, a total of 60 small and 60 big farmers were included, constituting a sample size of 120 respondents from the two taluks. Data were collected using a well-structured questionnaire designed to capture information on farmers' socio-economic characteristics, technological adoption and yield levels. The chi-square test was employed to analyze the association between independent variables and the technological as well as yield gaps of onion growers.

Results and Discussion

Association between independent variables and technological gap of small and big farm onion growers

In order to find out the association between independent variables and technological gap, chi square test was worked out. It is clear from Table 1 that variables like education, annual income, knowledge, risk orientation, innovative proness, scientific orientation, market orientation and mass media exposure were found to be significantly associated with the technological gap of onion growers at five percent significance level. Whereas, farming experience, extension contact and extension participation were having significant association with the technological gap of onion growers at one percent. However, variables like age and family size are had no association with the technological gap of onion growers. With respect small farmers variables like education, annual income, knowledge, risk orientation, innovative proness, scientific orientation, market orientation and mass media exposure were found to be significantly associated with the technological gap at five percent significance level. Further, farming experience, extension contact and extension participation were having significant association with the technological gap at one percent. However, variables like age and family size are not associated with the technological gap. In case of big farmers variables like education, annual income, knowledge, risk orientation, innovative proness, scientific orientation, market orientation and mass media exposure were found to be significantly associated with the technological gap at five percent significance level. Further, farming experience, extension contact and extension participation were having significant association with the technological gap at one percent. However, variables like age and family size are not associated with the technological gap.

Education had significant association with technological gap at five percent level, which indicates that an individual with a strong educational background possesses the capacity to comprehend and effectively utilize new technologies in onion cultivation, that results in less technological gap.

Association between independent variables and yield gap of small and big farm onion growers

It is found from the Table 2 that yield gap of onion growers significantly associated with variables like education, farming experience, annual income, knowledge, risk orientation, innovative proneness, scientific orientation, market orientation, extension contact, mass media exposure, extension participation at five percent level. Whereas, farming experience, extension contact and extension participation are associated significantly with yield gap at one percent level. However, age and family size had no association with the yield gap of onion growers. In case of small farmers variables like education, farming experience, annual income, knowledge, risk orientation, innovative proneness, scientific orientation, market orientation, extension contact, mass media exposure, extension participation has association with yield gap at five percent level. Whereas, farming experience, extension contact and extension participation are associated significantly with yield gap at one percent level. However, age and family size had no association with the yield gap. With respect to big farmers variables like education, farming experience, annual income, knowledge, risk orientation, innovative proneness, scientific orientation, market orientation, extension contact, mass media exposure, extension participation has association with yield gap at five percent level. Whereas, farming experience, extension contact and extension participation is associated significantly with yield gap at one percent level. However, age and family size had no association with the yield gap. Non-significant association was found between age and yield gap of onion growers as younger farmers tend to be more progressive, possess higher levels of knowledge, and are more inclined to adopt new technologies. Conversely, older farmers often exhibit traditional tendencies and are resistant to change, leading to their reluctance to embrace new technologies. However, it's worth noting that age may not be a critical variable that directly influences the yield gap. Education had significant association with yield gap at five percent. This suggests that an individual with a strong educational background tends to have better knowledge and the ability to effectively utilize new technologies in cultivation. This, in turn, leads to higher yields and a reduction in the yield gap. Family size was non-significantly associated with yield gap. This showed that size of family was not an important variable which influences on yield gap. Farming experience had significant association with yield gap at one percent. A grower with extensive farming experience typically possesses a higher level of knowledge and is more inclined to adopt new and recommended technologies. This adoption of technologies often leads to increased yield and a subsequent reduction in the yield gap. Annual income had significant association with yield gap at five percent. Income indeed plays a significant role in the adoption of new technologies in

farming. When a farmer has limited income, they may be constrained in their ability to afford the input costs associated with modern technologies. As a result, they might opt for traditional methods due to cost limitations. Conversely, the adoption of new technologies often leads to improved yields, but it's contingent on the farmer's financial capacity to invest in those technologies. Innovative proneness had significant association with yield gap at five percent. A person with more innovativeness always uses new and recommended technologies, which results in high yield. Scientific orientation had significant association with yield gap at five percent. The probable reason might be that scientific orientation serves as a catalyst that encourages onion farmers to become aware of scientifically recommended technologies. This increased awareness typically leads to the adoption of these recommended practices, results higher yield. Market orientation had significant association with yield gap at five percent level. The observed trend can be explained by the fact that onion growers who have a higher level of market orientation are more inclined to embrace market-driven practices. This orientation leads to a decrease in the overall yield gap. Extension contact had significant association with yield gap at one percent. The probable reason for this situation might be that extension contact offers farmers valuable opportunities to seek new information from horticultural officers and private agency extension officers regarding onion cultivation practices. This interaction helps to improve their knowledge level, and as a result, they are more likely to adopt recommended technologies. Ultimately, this adoption contributes to increased yield in onion crop. Mass media exposure of the onion growers had significantly association with yield gap at five percent. The reason for this phenomenon could be attributed to higher mass media participation, which offers growers the opportunity for repeated exposure to innovative practices information and boosts the adoption of such technologies, reduces yield gap. Extension participation had significant association with yield gap at one percent. Active involvement of onion farmers in different extension programs has likely enabled them to engage with extension officers and other farmers who also participate in events like demonstrations, meetings, and training sessions. This exposure provides them with the chance to learn about innovative farming techniques, ultimately assisting them in becoming familiar with these technologies and adopting them. thereby leading to improved crop yields.

Table 1: Association between Independent variables and Technological gap of small and big farm onion growers

Sl. No	Characteristics	Small farm Growers (n_1=60)		Big farm Growers (n_2=60)		Onion growers (n=120)	
		χ2 value	C	χ2 value	C	χ2 value	C
1	Age	5.06^{NS}	0.27	6.45^{NS}	0.31	6.28^{NS}	0.22
2	Education	14.83*	0.44	16.17*	0.46	14.46*	0.32
3	Family size	5.20^{NS}	0.28	7.28^{NS}	0.32	7.48^{NS}	0.24
4	Farming experience	14.05**	0.43	14.54**	0.44	15.65**	0.33
5	Annual income	12.80*	0.41	11.85*	0.40	12.27*	0.30
6	Knowledge	12.98*	0.42	11.58*	0.40	11.70*	0.29
7	Risk orientation	12.27*	0.41	13.03*	0.42	13.54*	0.31
8	Innovative proneness	11.59*	0.40	10.45*	0.38	10.67*	0.28
9	Scientific orientation	12.60*	0.41	12.21*	0.41	11.21*	0.29
10	Market orientation	12.72*	0.42	12.35*	0.41	13.25*	0.31
11	Extension contact	13.82**	0.43	14.38**	0.44	14.46**	0.32
12	Mass media exposure	13.01*	0.42	12.65*	0.42	12.70*	0.30
13	Extension participation	15.33**	0.45	14.40**	0.44	15.63**	0.33

NS-Non-Significant *-Significant at 5 percent **-Significant at 1 percent

Table 2: Association between Independent variables and Yield gap of small and big farm onion growers

Sl. No	Characteristics	Small farm growers (n_1=60)		Big farm growers (n_2=60)		Onion growers (n=120)	
		χ2 value	C	χ2 value	C	χ2 value	C
1	Age	5.82^{NS}	0.29	4.87^{NS}	0.27	5.65^{NS}	0.20
2	Education	17.90*	0.48	18.39*	0.48	17.83*	0.35
3	Family size	4.02^{NS}	0.25	5.26^{NS}	0.28	6.35^{NS}	0.22
4	Farming experience	15.74**	0.45	15.49**	0.45	15.83**	0.34
5	Annual income	12.32*	0.41	12.28*	0.41	13.28*	0.31
6	Knowledge	10.35*	0.38	12.17*	0.41	12.30*	0.30
7	Risk orientation	12.51*	0.41	11.03*	0.39	13.65*	0.32
8	Innovative proneness	10.66*	0.39	11.35*	0.40	11.09*	0.29
9	Scientific orientation	11.72*	0.40	12.02*	0.41	12.65*	0.30
10	Market orientation	11.17*	0.39	9.95*	0.37	11.78*	0.29
11	Extension contact	14.84**	0.44	15.76**	0.45	14.75**	0.33
12	Mass media exposure	10.58*	0.38	12.92*	0.42	13.28*	0.31
13	Extension participation	15.93**	0.45	10.45*	0.38	14.12**	0.32

NS-Non-Significant *-Significant at 5 percent **-Significant at 1 percent

Conclusion

The study revealed that technological and yield gaps in onion cultivation are strongly influenced by farmers socio-economic and behavioural characteristics rather than demographic factors like age and family size. Education, income, knowledge, innovativeness, scientific orientation, market orientation and access to mass media were all found to play a critical role in reducing gaps, while farming

experience, extension contact and participation showed the highest level of significance. These findings confirm that better-informed and better-connected farmers are more likely to adopt recommended practices, resulting in improved productivity and profitability. The results highlight the importance of strengthening extension networks, ensuring timely dissemination of knowledge and promoting innovative and market-oriented practices. Focused training programs, improved access to scientific information and capacity building in risk management can further motivate farmers to embrace modern technologies. Addressing these factors will be crucial in bridging both technological and yield gaps, thereby enhancing the efficiency, stability and income security of onion growers in Chitradurga district.

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