

# **Multi-Agent System for Hospitals**

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## **Abstract**

Here we show that the set of functional agents (ENT, Cardiology, Surgery, etc.) is the same in low cost as well as premium medical services. However, if patients are generated in low-cost medical services, then it should go for simple ‘integrative agent’.

## **Keywords**

Medical Services, Low-Cost players, Differentiator and Functional Agents.

## **1. Theoretical Framework**

In supply chains, Multi-Agent system is regarded as a panacea to the automation of complex processes; and reduction of manpower. The agent is an independent entity that interacts with the environment. Agent(s) typically represent expert(s) in their respective field(s). In the context of businesses, Agents are typically production function, finance function, marketing function, R&D function, HR function, etc. These are in accordance with what Lawrence and Lorsh recommended in their paper as differentiation. And these functions have specialists who have their own agenda; for example left to marketing professionals they want high product variety, rapid fulfillment of demand (by sending half filled trucks to the customers); and this is opposed by production professionals as they are trained in cost minimization, longer production runs to have economies of scale etc. There is a need to integrate these functions so that all functions move in a nearly same direction.

And this entity in a multi-agent system is the ‘integrative’ agent. Thus the multi-agent system is very complex. Typically ‘integrative agent’ is very complex. Hence we have the following hypothesis.

*H0: In cost leadership strategy it is easy to implement Multi-Agent System as uncertainty is very low, and in differentiation/innovation strategy it is relatively difficult to implement the multi-agent system as uncertainty is high (as that makes the job of preparing good quality agent much difficult).*

(A1): It is known that in MAS (multi-agent system) for firms with cost leadership strategy the integrating agent is centralized, and in MAS (multi-agent system) for firms with differentiation strategy the integrating agent is decentralized.

Above is true in general for the manufacturing and service sector.

Here we propose that in the case of hospitals, each agent represents a discipline as cardiology, pathology, ENT etc. (as in business organizations we have marketing, production, finance, and R&D agents) that embodies the knowledge base of a given branch/field of medicine.

In medical fields, this issue of 'integration' is very severe. For example, if BP is high due to the application of saline drip, the patient is advised to drink a lot of water to flush out excess salt from the system. On the contrary, a kidney specialist always recommends that people should not drink too much water.

H1: However we argue that *in case of hospitals geared to give medical service for both cost leaders and differentiation strategy, it will have an integrating agent that is decentralized (as customers with deep pockets and not so deep pockets have a similar human body and have the same need for integration). This is so because integration happens at doctor (functional agent) level.*

*If the volume of traffic is not very large, then we may not be able to afford premium services of a complex system, and hence in low-cost medical business, services of 'integrative' agent may not be sought; and 'integrative agent' may be deployed in premium medical services only.*

From a business point of view: producers of 'integrators' could have different versions, starting from a basic model to a highly comprehensive 'integrator' (with of course varying costs). Alternatively, we could consider custom made 'integrator'. It could be considered that we may take a modular approach (for example a module may consider the integration of heart and knee joints) and supply several modules; instead of writing a monolithic software for 'integrator'.

In a large country where masses are looking for medical attention, a multi-agent system would be a good alternative.

## 2. Conclusion

We have given the hypotheses on types of multi-agent systems in the context of hospitals. We are undertaking an empirical investigation to verify the above propositions.

## References

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## Biographies

**Sheela R. Sharma** is MBBS and MD (Obste & Gynea). She has practiced as a private consultant for the last 30 years. She is Associate Professor at Rama Medical College at Kanpur India.

**Ajay Jha** is currently a fulltime research scholar at Indian Institute of Technology Kanpur. Mr. Jha holds a B. Tech. degree in Mechanical Engineering from Harcourt Butler Technological Institute, Kanpur and a M. Tech. in Industrial and Management Engineering from Indian Institute of Technology, Kanpur. He has rich experience of production and marketing domains of over 10 years and also of teaching mechanical engineering and operations Management courses of 10 years. His research areas include Supply Chain Management and Strategy.

**R. R. K. Sharma** has had 30 years of career to date. Started as graduate engineer trainee with TELCO (Pune) (now Tata Motors India) during 1980-82, and later went on to do Ph.D. in management at I.I.M., Ahmadabad, INDIA. After Ph. D. in management, he worked with TVS Suzuki (for 9 months) as executive assistant to GM

(marketing). Now he has 26 years of teaching and research experience at the Department of Industrial and Management Engineering, I.I.T., Kanpur, 208 016 India. He has taught over 22 different courses in management at IIT Kanpur India (to B. Tech., M. Tech. and M.B.A. students) and is well versed with all the facets of management and has unique ability to integrate different areas of the subject. To date he has written over 507 (total) publications (220 Full-Length Papers and 287 Extended Abstracts Outlining Theoretical Framework) in international/national journals and six research monographs). He has developed over 8 software products. Till date, he has guided 58 M TECH and 15 Ph.D. theses at IIT Kanpur. He has guided 129 Special Studies Projects for MBA IInd year students of IME, IIT Kanpur. He has been Sanjay Mittal Chair Professor at IIT Kanpur (15.09.2015 to 14.09.2018).