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Globally Distributed R&D Work in a Marketing Management Support Systems (MMSS) Environment: A Knowledge Management Perspective

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ABSTRACT

Globalisation, liberalization and rapid technological developments have been changing business environments drastically in the recent decades. These trends are increasingly exposing businesses to market competition and thus intensifying competition. In such an environment, the role of marketing management support systems (MMSS) becomes exceedingly important for the long-term growth of an organisation's marketing expertise and success. In this paper, we discuss the evolution of a globally distributed R&D project spanning three continents in developing an MMSS for the motion picture industry. We first provide the conceptual background of the MMSS and knowledge management systems relevant for our work. We then provide a detailed case study of our MMSS implementation. We specifically focus on the following elements of our work: globally distributed R&D efforts, knowledge elements, and fit between demand and supply sides of MMSS. We conclude with a discussion of implications for future research in this area.

Keywords: Globally Distributed Work, Marketing Management Support Systems, Knowledge Management

INTRODUCTION

Deregulation (liberalization), globalisation, and rapid technological developments have been changing business environments drastically in the recent decades. These trends are exposing businesses to market competition at a greater extent. The intensified competition induces firms to aim for a more targeted product line, greater number of merger and acquisitions, and experiment with a variety of delivery channels. As firms race toward more competitive positions, knowledge becomes a significant

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driver of competitive advantage under a globally deregulated business environment.

With the easing of national barriers, managing knowledge has become essential to accessing timely information about international competitive environments, regional growth rates, and economic and cultural issues for building a global business portfolio. The penetration of the Internet has been one of the major catalysts that are speeding up this process. With the increase in virtual collaboration and remote teaming among highly distributed teams across the globe, the partnering firms need both explicit and tacit knowledge sharing. Businesses that were once organized along geographic lines are now reorienting themselves according to markets, products, and processes. Companies such as Lotus, Verifone, and Microsoft are using this phenomenon to their advantage by shifting "mental labor" intensive software development to their programmers in India and Russia (Tiwana 2000). For example, in year 2000, 185 of Fortune 500 companies outsourced software development to India alone and the amount of outsourcing grew at a *53%* yearly rate according to report by the National Association of Software and Service Companies (Mockus and Herbsleb 2001).

In such a dynamic and competitive environment, the management of R&D as well as marketing functions becomes very important. It is challenging to manage diverse R&D teams spread across geographical boundaries. One effective way to increase the efficiency of the marketing function is to make good use of marketing management support systems (MMSS) for the long-term growth of the organisation. In this paper, we report the evolution of a globally distributed R&D work spanning three continents in developing an MMSS for the motion picture industry.

The R&D work reported here is collaborative in nature between industry and academia, in which a company (to be discussed in detail in later sections) identified a series of scheduling problems whose solutions were developed by the university-based scientists. From a knowledge management perspective, therefore, we make a distinction between academic knowledge (R&D work) and practice. Moreover, the type of knowledge generated by the collaborative work is a special kind of knowledge from an organizational perspective. This is in contrast with the R&D knowledge that is generated completely "in-house" or "outsourced" by the organization.

We first provide a theoretical background in the area of developing analytical MMSS tools in a knowledge environment. We then provide a detailed account of the case study of MMSS implementation. In discussing the case study, we focus on the following perspectives: (i) a global resource generation perspective, (ii) fit between the supply and demand sides of the MMSS, and (iii) knowledge management. We conclude with a discussion of future research implications in this area.

CONCEPTUAL BACKGROUND

MMSS Implementation and Challenges

A marketing management support system (MMSS) is defined as any system combining (1) information technology, (2) analytical capabilities, (3) marketing data, and (4) marketing knowledge, made available to one or more marketing decision maker(s) to improve the quality of marketing management (Wierenga and van Bruggen 2000). Since this definition is at a fairly general level of specification, it encompasses a variety of tools and systems, such as, models, information systems, DSS, expert system, and knowledge-based systems. A list of the types of MMSS's and their summary characteristics is provided in Table 1.

Knowledge Management

What is Knowledge Management?

Knowledge is a fluid mix of framed experience, values, contextual information, expert insight and grounded intuition that provides an environment and framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knower. In organizations, it often becomes embedded not only in documents or repositories, but also in organizational routines, processes, practices, and norms. Knowledge management, therefore, enables the creation, communication, and application of knowledge of all kinds to achieve business goals.

Types of Knowledge

There are two major types of knowledge in an organization: tacit and explicit knowledge. Tacit knowledge is personal, context-specific knowledge which is difficult to formalize, record, or articulate, whereas the explicit knowledge is well-documented, codified and transmitted in a systematic and formal language through documents, databases, web, w-mails, and so on.

Table 1: Characteristics of Marketing Management Support Systems

Type of MMS	Characterizing Keywords
Marketing Models (MM)	· Mathematical representation · Optimal values for marketing instruments · Objective · Best solution
Marketing Information Systems (MKIS)	· Storage and retrieval of data · Quantitative information · Registration of "what happens in the market" · Passive systems
Marketing Decision Support Systems (MDSS)	· Flexible systems · Recognition of managerial judgment · Able to answer "why" questions (analysis) and "what-if" questions (simulation)
Marketing Expert Systems (MES)	· Centers on marketing knowledge · Human experts · Rule-based knowledge representation · Normative approach: best solution
Marketing Knowledge-Based Systems (MKBS)	· Diversity of methods, including hybrid approaches · Structured knowledge representation, including frame-based hierarchies · Model-based reasoning
Marketing Case-Based Reasoning Systems (MCBR)	· Similarity with earlier cases · Storage of cases in memory · Retrieval and adaptation · No generalization
Marketing Neural Networks(MNN)	· Training associations · Pattern recognition · No a priori theory · Learning
Marketing Creativity Support Systems (MCSS)	· Association through connections · Idea generation · Endorse creativity in problem solving

What Can Be Leveraged in Knowledge Management?

There are a number of useful leveraging elements in knowledge management, such as (Tiwana 2000): (i) collaboration and collaborative knowledge sharing, (ii) conversation as a medium for thought, (iii) easy to find sources of the technical know-how, locate people and expertise, and reuse what exists either in a tangible form, or in people's minds, (iv) ability to provide decision support, (v) flexibility and scalability, (vi) pragmatism, (vii) user-orientation, and (viii) ease of use. We elaborate below on another important leveraging element, namely, the Internet.

Leveraging the Internet

A quick glimpse of existing technology in most companies reveals a transformative addition – the Internet. It provides integration of the islands of information across the organizational landscape. Certain characteristics of the Internet have made it an inevitable choice for globally distributed R&D projects. The global reach of the Internet has the following key implications: (i) a cost-effective global network backbone, (ii) ubiquity, (iii) distributed connectivity (i.e., distributed resources and databases can be interconnected cost effectively and reliably, using virtual networks), (iv) robust global data path, (v) cheaper, faster, and directly usable global competitive intelligence, and (vi) platform independence in terms of a number of data formats and platform-dependent forms.

CASE STUDY: AN EVOLUTIONARY DEVELOPMENT OF AN MMSS IN MOVIE INDUSTRY

Building on the discussion so far, we now discuss the evolution of a globally distributed R&D project spanning three continents in developing an MMSS for the motion picture industry. The motion picture industry represents an area where MMSS have a high potential for helping managers**,** but an unpredictable chance to succeed. This is because the decision environment is quite dynamic, contractual arrangements between parties are complex, management turnover appears to be high, and, perhaps, most importantly, the cognitive style of the decision makers is often non-analytical or heuristic (Eliashberg et al. 2001; Wierenga, Van Bruggen, and Staelin, 1999). These characteristics represent challenges in developing implementable models for decision makers in this industry. In this section, we present an evolutionary account of the development of an MMSS in this industry, starting with a scheduling model, namely, SilverScreener (Swami, Eliashberg, and Weinberg 1999), and evolving into varied applications (Eliashberg et al. 2001; Eliashberg et al. 2006a).

The Problem Hierarchy

We first present the major entities of a typical supply chain in motion picture industry (refer Figure 1). Movies are, in general, produced and distributed by major studios (e.g., Paramount, Warner Brothers), and played by an exhibitor (e.g., United Artists). An exhibitor's scheduling problem can be summarized as: *which movies to choose to show each week and for how long to play them*.

This exhibitor's problem can be addressed at two levels: *macro-scheduling* (a weekly scheduling problem at the entire theater chain level) and *micro-scheduling* (a daily scheduling problem at an individual theater level). Figure 3 shows these views for a multiplex chain. The macro level problem, when solved by SilverScreener model, recommends a weekly list of recommended movies for each theater. A Senior Manager of theater programming at the chain's Central Office uses this model's recommendations to decide on a list of movies to be played for the coming week for each theater screen. The micro level problem is then solved for within the week, or daily planning for individual theaters. Pictorially, Level 1 or macro planning view can be presented as shown in Figure 2. Based on a consideration set of movies available from distributors in the market, the planner selects a subset of movies for scheduling in the coming weeks. The output of macro problem plus some additional parameters such as screen capacities, and demand forecasts, are used as inputs to the Level 2 problem of micro-scheduling. The output from this process provides a screening schedule of movies (screen, time slot, movies) during different times of the day.

Knowledge Elements

In the MMSS implementation project in the movie industry, we have used several knowledge elements as listed below.

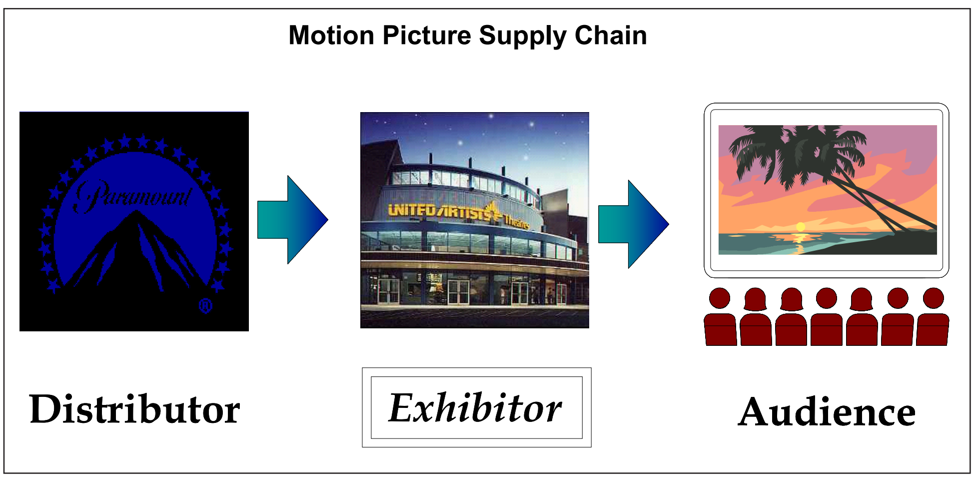

Fig. 1: Motion Picture Supply Chain

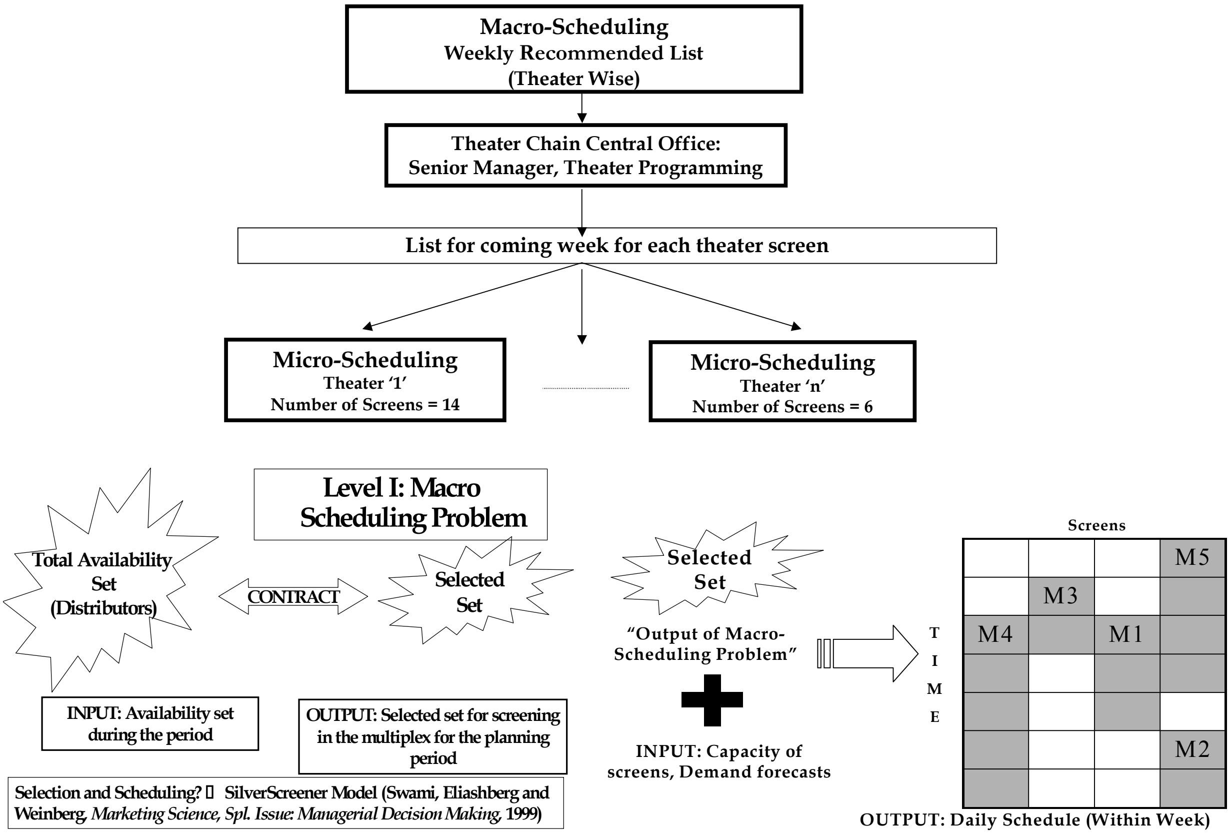

Fig. 2: A Schematic View of Macro and Micro Versions of the Exhibitor's Problem

Knowledge about the movie industry

A comprehensive review of the state-of-the-art research in the movie industry appears in Eliashberg, Elberse and Leenders (2006). A rapidly emerging stream of research in this field addresses various research aspects, such as, scheduling, forecasting, contract design, consumer behavioral aspects, and online recommendation systems. Movies are considered as one of the most dynamic industries in many countries/cultures due to the emergence of various innovations and technologies, such as, digital production and exhibition, and newer retail formats, such as multiplexes or megaplexes (sci-tech-today.com 2005, Jardin 2005). Movies are interesting because of their experiential nature, which requires co-creation by both producer and consumer to consummate the consumption. This aspect raises distinctive challenges because the same product (i.e., movie) may appeal differently to different people making the task of forecasting movie's demand or success probability a difficult one (Eliashberg, Jonker, Sawhney, and Wierenga 2000).

A key property of the demand pattern of majority of movies, that renders complexity to several movie scheduling problems, is exponential decay of demand over time (Krider and Weinberg 1998). This demand perishability view for multiple movies, coupled with a sliding scale box-office revenue-sharing contract between the distributor and the exhibitor, makes movies scheduling problem a non-trivial one (e.g., Swami, Eliashberg, and Weinberg 1999). As a contrast, in inventory control problems, perishability is typically considered in terms of physical deterioration of a product (e.g., a grocery item with an expiry date). This view comes from the supply side of the product. The movie scheduling problem adopts a "demand side view" in which the physical product (i.e., a copy of the movie) remains the same, but its demand perishes over time.

Modeling in Operations Research and Implementation

Several operations research models were developed and implemented at different locations of the Pathe theaters as part of this project. A brief description of these is provided in the sections below.

Macro Planning: SilverScreener Model

SilverScreener is aimed at helping exhibition managers make better decisions by using a mathematical programming approach and a fast, but readily accessible algorithm (Swami, Eliashberg, and Weinberg 1999). The mathematical program used is an integer linear program. The major objective of the program is to help select and schedule movies for a multiple-screens theater over a fixed planning horizon in such a way that the exhibitor's cumulative profit is maximized. Swami, Eliashberg, and Weinberg (1999) propose a two-tier integrated application of the model. The first tier involves development of a *movie selection plan* to help the manager plan an entire season and bid for movies before the start of that season. The second tier – *adaptive scheduling* – of the integrated approach helps the exhibitor in weekly decision making during the season. This application involves "rolling," and updating data, from one week to the next. Each week's attendance data can be used in the model. Swami, Eliashberg, and Weinberg (1999) provide various analyses of normative versus actual decision making, based on publicly available data.

Implementation of SilverScreener Model at a Single-Screen Theater

SilverScreener was implemented and used by Holland's leading movie theater company (Pathé) for a single location (Eliashberg, Swami, Weinberg, and Wierenga 2001). The model was implemented on a weekly basis using the adaptive scheduling approach of SilverScreener from Week 45, 1999, to Week 8, 2000.

Multi-Theater Application of SilverScreener Model at Pathe, Holland

Pathé management, having gained confidence in the model and the modeling team on the basis of the single-location implementation, asked us to develop a system that would be available every Monday morning to make recommendations as to which movie should be scheduled for each screen across all their movie theaters in Amsterdam (refer Eliashberg, et al. 2006a). For this more complex assignment, the following additional issues had to be taken into account in the mathematical model: pre-commitments (e.g., contractual agreements with distributors to show a particular movie in a particular screening room of a particular theater during a specified number of weeks); special treatment for kid's movies and matinee movies; cannibalization of a movie's sales in one theater by its revenues in another theater; and complexity rendered by different numbers of screens in the different theaters, different screening room capacities, different demand situations (translating into different prognoses for box office sales for the same movie in different theaters, and different consideration sets (sets of possible movies to be shown). The algorithm was based on solving the above multi-theater problem as a separable set of single movie theater problems. A conceptual view of our implementation plan, as explained above, is shown in Figure 3.

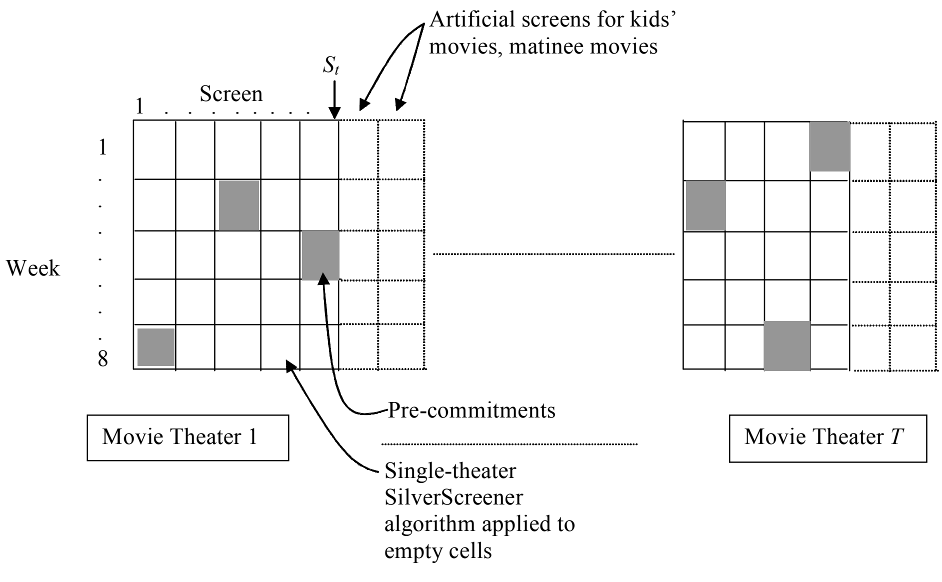

Fig. 3: Conceptual View of Multi-Theater Screen Scheduling Implementation

Micro-Scheduling Algorithm: From SilverScreener to SilverScheduler

As movie theaters have evolved from single screen theaters to multiplexes (sometimes involving 20 or more screens), the problems of scheduling the movies onto screens has become increasingly complex (refer Figure 4). Some of the key reasons for that complexity are as follows: (i) there is a large number of different movies with different running times that the theater wants to show in a typical week, (ii) the number of seats per screening room differs, (iii) there is variability in demand for movies, with respect to the movie type, time of the day and day of the week, (iv) there are different genres of movies, which has implications for their scheduling, (v) constraints posed by the logistics of a movie theater, such as, opening and closing times and cleaning times, and (vi) management specified constraints (e.g., the time between two movie starts should never be more than 20 minutes). The problem considered in the micro-scheduling algorithm is how to make a schedule of the different movies on the different screens during a given week, which obeys all the constraints and maximizes the number of visitors.

Based on the mathematical programming techniques of integer programming, and column generation, we have developed a procedure that produces an optimal movie program for a given week, given the list of movies to be shown, their running times, demand, the capacities of the different screening rooms, information about contractual agreements, and any other constraints, as applicable. This system is labeled as *SilverScheduler*.

Use of Statistics and Forecasting Approaches

SilverScreener Model

The SilverScreener model makes use of an ex ante revenue prediction scheme for the first tier, movie selection plan. This is based on the attributes of the movies, such as, genre, stars, distributors, etc., and also makes use of the analogical reasoning, such as, a "matching" movie from previous seasons. The second tier, the adaptive scheduling approach, makes use of the actual data available about a movie to use it in a two-parameter exponential revenue prediction model.

Implementation Applications

In the implementation cases, there was the issue of making forecasts for newly released movies, for which no box office data are yet available. In our one-theater study with only 6 screens, we simply asked management to make judgmentally numerical predictions, based on

Time	Screen	1	2	3	4	5	6	7	8	9	10	11	12	13
	Capacity	222	222	340	113	102	161	163	172	175	177	382	96	90
11:30	1		HPOV											
11:40	2													
11:50	3				OT									
12	4					SNDT								
12:10	5												ZL	
12:20	6						DOH				PD			
12:30	7								HPNL					
12:40	8									LOTR				
12:50	9			O11										ASH
13:00	10							MNS						
13:10	11											LOTR		
13:20	12	DSAW			OT	SNDT								
13:30	13												ZL	
13:40	14													
13:50	15		HPOV											
14:00	16													

Fig. 4: A Representative View of Micro-Scheduling Problem Solution

their experience, or to provide a "matching movie," a movie that is similar to the new one, and for which historical data are available. In the second application, for the larger number of theaters and screens, we devised a movie classification scheme, which utilizes managerial judgmental information, without the manager having to make numerical forecasts for individual movies.

A key input to the micro-scheduling algorithm is the demand information about the movies in the movie list. For each movie in the movie list we need to have a forecast of the number of visitors that this movie will generate in a showing. This number has to be available for each day of the week and for each different starting time of the movie (using intervals of one hour). For this purpose, we developed a forecasting procedure with two modules. The first module is for movies that have been running already. The observed numbers of visitors are used to estimate a forecasting model. The second module is for newly released movies, where the numbers of visitors are forecasted in an indirect way, using the characteristics of a movie as determining variables.

Computational capabilities

The model developments, as well as implementation approaches, made extensive use of the state-of-the-art computing resources, such as fastest PC's and UNIX systems, various software (e.g., AMPL/CPLEX, C, C++, MS-Office), and broadband internet.

Fit between Demand and Supply of MMSS

As mentioned earlier, the fit between demand and supply is essential for a successful MMSS. First, by global sourcing of R&D talent, we have been able to provide the best fit possible, both in terms of expertise and timeliness. Then, by the local presence of one of the team members near the potential users helped facilitation of direct and personal interaction. Further, our implementation strategy was guided by Wierenga, Van Bruggen and Staelin's (1999) framework, which relates the success of a MMSS to a number of factors: *demand side* factors, *supply side* factors, the *match* between demand and supply, *design characteristics* of the MMSS and characteristics of the *implementation process* (see Figure 5).

The *demand side* of the MMSS is movie programming at Pathé, The Netherlands. As noted earlier, Pathé is the largest movie theater company in the Netherlands With a very high market share. The Programming Department

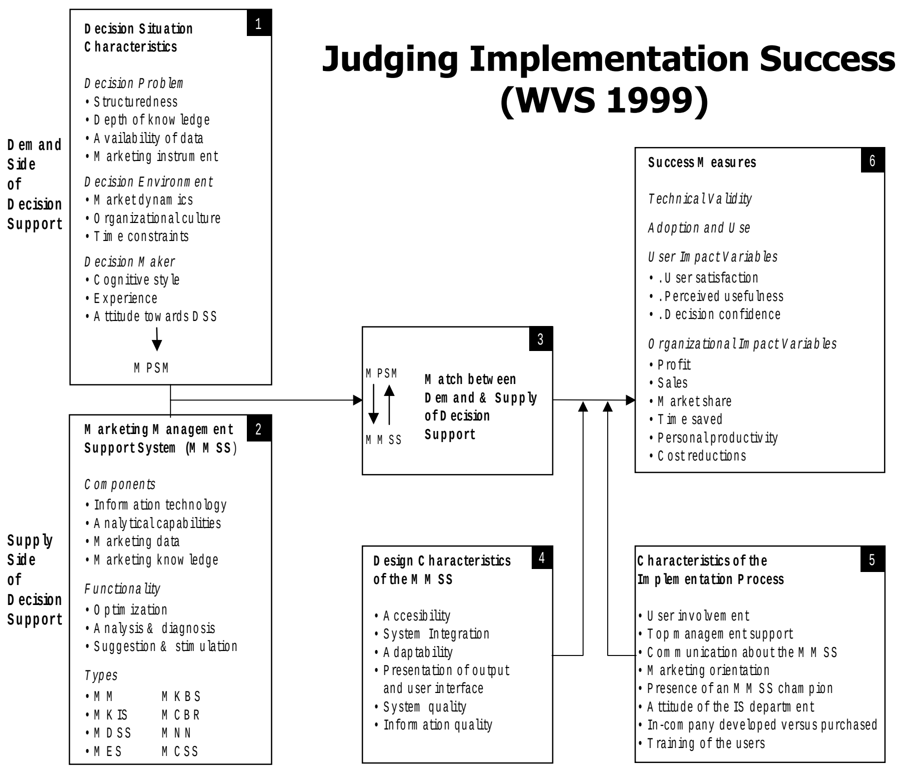

Fig. 5: Integrative Framework of the Factors that Determine the Success of a Marketing Management Support System (Wierenga, Van Bruggen, and Staelin 1999)

of Pathé chooses which movies to play in which theater(s) and on which screen, in a given week. In the Netherlands a new movie week, starts every Thursday. Every Monday morning a team of three people meets and jointly prepares a movie allocation schedule for all the Pathé screens in the country for the following movie week, effective the next Thursday.

Using the implementation framework, the following strategy was determined citation:

- An environment was chosen with a relatively favorable initial attitude towards a marketing management support system.
- An excellent technical match was made between the decision problem and the marketing management support system.
- Given the low experience with models (and analytical methods in general) in the organizational environment, the MMSS was operated externally.
- The SilverScreener's recommendations were accessible instantly through the Internet to the decision makers, and presented in a very user-friendly way.
- Constant involvement of the users was maintained during the process.

Role of Enabling Technologies

The timing of events is of immense importance in the adaptive scheduling applications of the type discussed here (see Figure 6). The coordination of the implementation involved activities spanning three continents – North America, Asia and Europe. The research collaborators on this project are based in the U.S., India, Canada, and The Netherlands. While the empirical analysis, execution of the model and the final recommendations were conducted each week at the Indian Institute of Technology, Kanpur, India, the implementation site is in The Netherlands. At the same time, frequent discussions were occurring among the researchers via e-mail across the three continents. Therefore, proper coordination of activities in this project required continual use of the information and Internet-based technologies. Figure 4 shows the occurrence of different events in a Movie Week for Movie Weeks 45, 46, and 47 in 1999.

In our projects, the analytical solutions were literally carried out nearly half way around the world from the implementation site. With communication costs virtually zero, and therefore geographic proximity not a requirement, a diverse team of researchers has been assembled to address a challenging problem. Thus, one important role of the internet is to make it easier to increase the size of a team with less co-ordination effort than is required otherwise. Further, the internet facilitated nearly 24 hour work cycles, because the time difference between India and Holland allowed us to wait for latest weekend data before transmitting the schedules to Holland just-in-time for the manager's Monday-morning discussions.

The Information and Communication Technologies (ICT), therefore, open new possibilities for marketing management support systems: the option of centralized expert centers with decentralized applications. The various documents formats, and their accompanying technologies used in our projects are shown in Figure 7. As our project implementations have shown, it is not necessary to have highly qualified model builders or even high-level software at the physical location of the application. Even ongoing optimization can take place from a very distant place. A company does not necessarily have to own or operate an MMSS itself, but may subscribe to an MMSS service from a place elsewhere in the world. This brings very sophisticated MMSS within the reach of even small companies who do not have the resources to acquire the expertise and the software themselves.

Success Measures

Our R&D efforts provided different results at different stages of the project. These are explained below.

SilverScreener Model Results

Our results suggested the following: (i) the exhibitor can achieve substantially higher cumulative profit, (ii) the improvement over actual decisions in terms of profitability appears to result from a combination of both better selection and improved scheduling of the movies, and (iii) the general structure of the optimal normative policy in a representative setting is a prescription to focus on *fewer "right" movies and run them longer* (Swami, Eliashberg, and Weinberg 1999).

Implementation Results

In the case of single-theater implementation, the face validity of our recommended schedules to Pathe was very

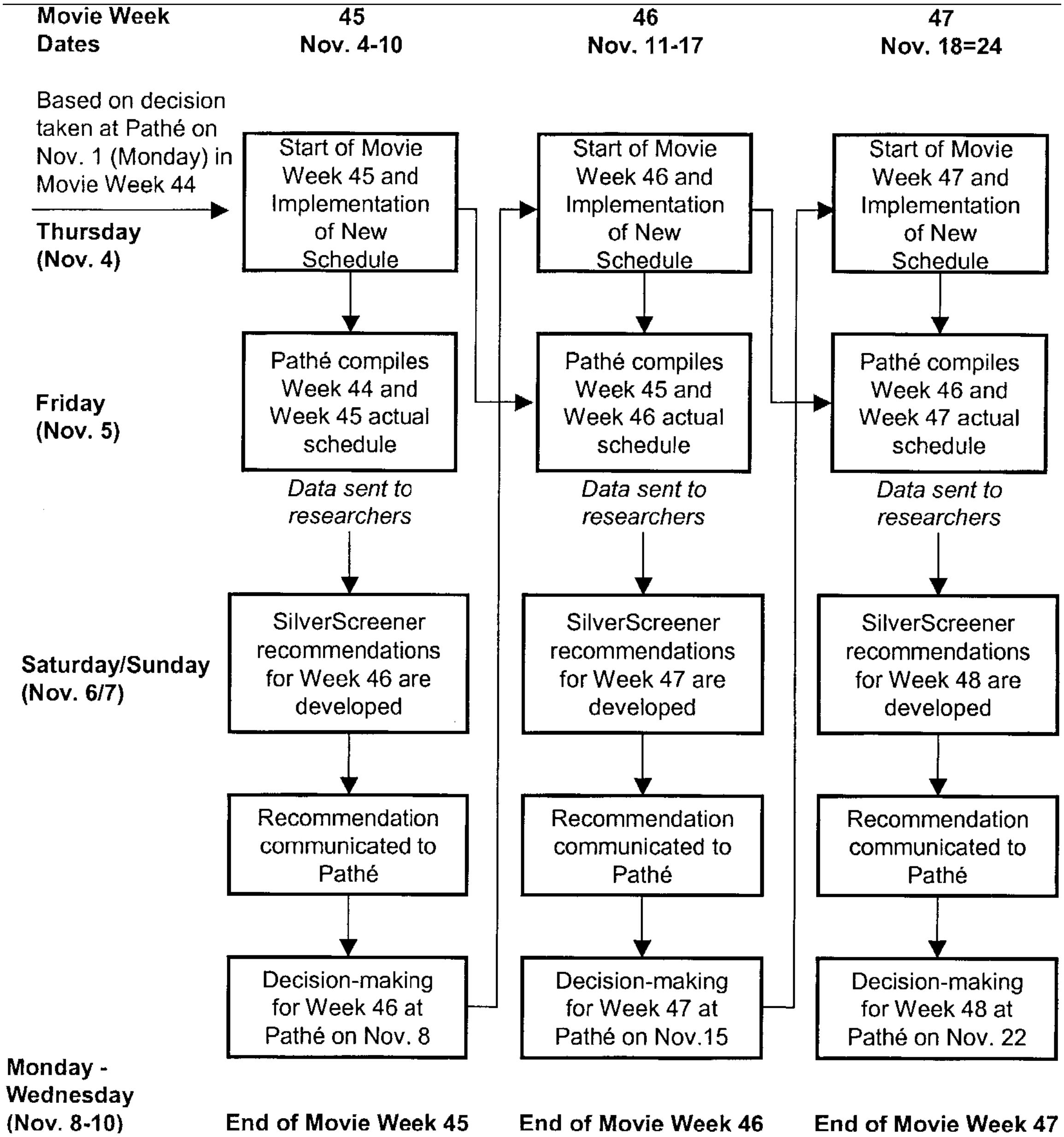

Fig. 6: Time-Line of Transmission of Data and Recommendations

high with at least 5 of the 6 weekly recommended movies matching the actual schedule every week. The *profitability analysis* of the model, which was done on a weekly basis, showed that the change in attendance at the model-aided theater was much higher than that for the other two theaters. Using Schultz and Slevin (1975) scale, we also measured the attitude towards SilverScreener among the members of the Pathé Programming Team, at three different times: before the implementation, after the first effective implementation period, and after a change in management. Our results showed that, for all the managers involved, the attitudes towards SilverScreener became more favorable over time.

In the case of multi-theater implementations, our results were projected to an annual improvement in overall net margin of approximately • 700,000. To examine the extent to which SilverScreener recommended movies played in the same capacity screen and movie theater as that actually scheduled by the manager, we examined the metric of weighted capacity match (weighted by screen capacity) for the implementation period. The average match percentages

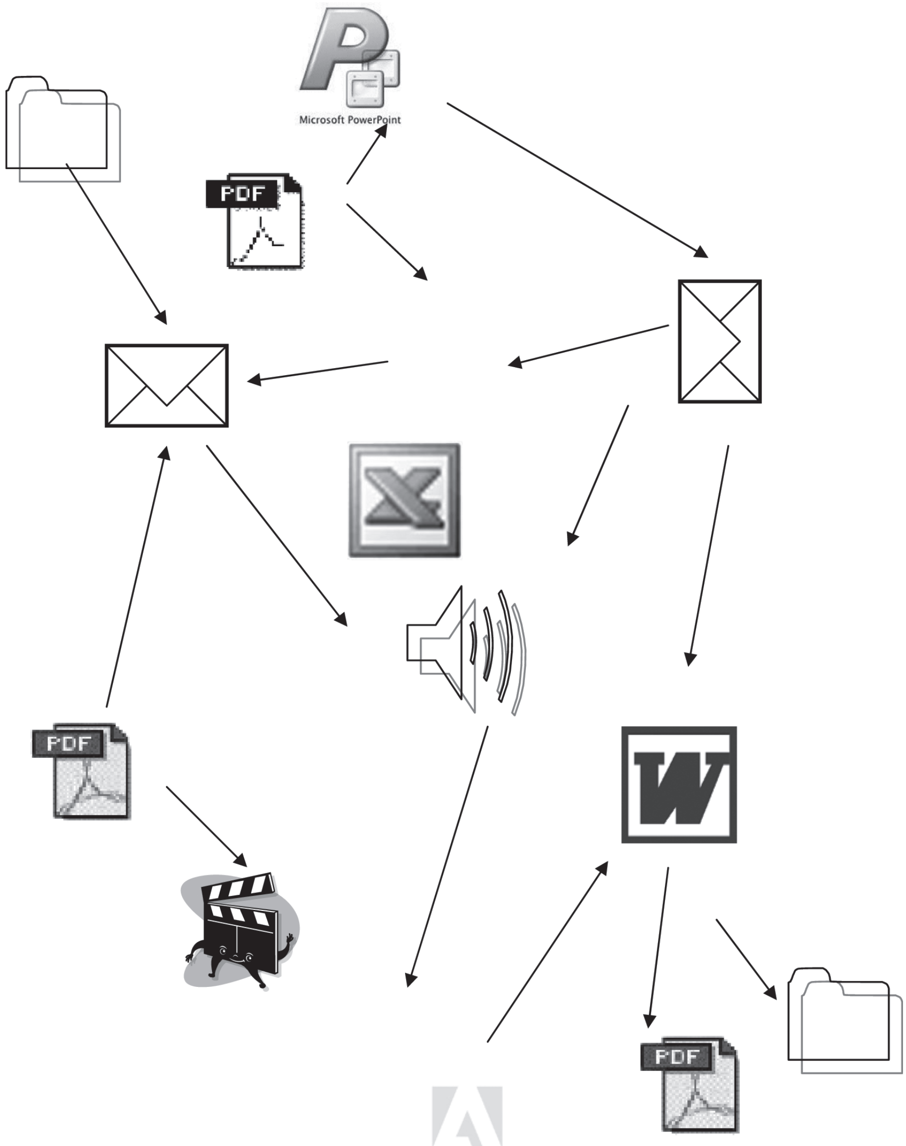

Fig. 7: Various Data Formats and Technologies Used in the Project

were of the order of 60% across movie theaters, and weeks. As theater managers have knowledge which is not incorporated in the MMSS, we believe this is a reasonable outcome.

Global and Evolutionary R&D Perspective

In our project, we dealt with a very local problem, namely, scheduling problems of Pathe in Amsterdam, but through a global perspective, we mobilized resources and knowledge from around the world. The expansion of our R&D network from a three-member team to eight members, across several countries (USA, Canada, The Netherlands, and India) and specializations (marketing, operations, management science, mathematics) is shown in Figure 8. An evolutionary view of our application efforts in this domain is shown in Figure 9 (the last names of the research collaborators form the acronym mentioned for each work).

From our project implementations, it became clear that, as the work became more complex, additional expertise was needed. With an 8-person team, it is literally true that some of the people have never met each other. We anticipate that, in such an organization of R&D efforts, the role of delegation and smaller team formation will become important.

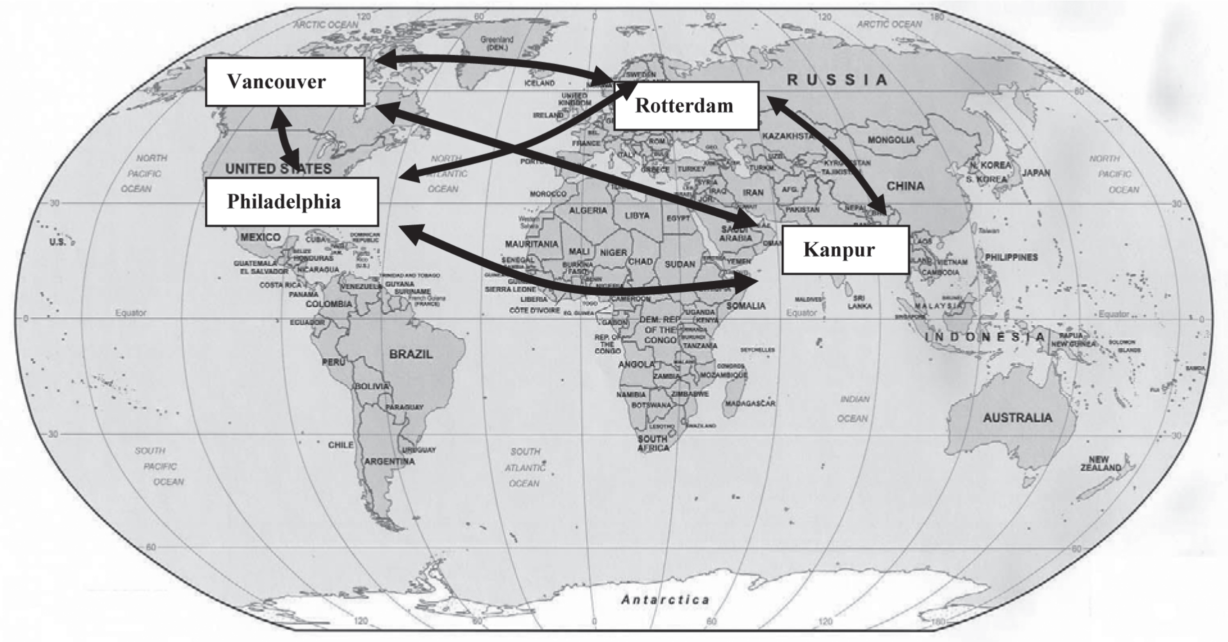

Fig. 8: A Geographical Network View of R&D Collaboration in the Project

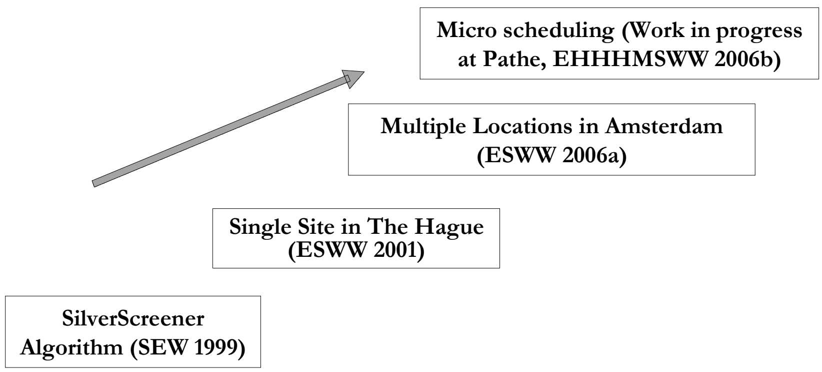

Fig. 9: An Evolutionary View of Implementation Efforts

CONCLUSIONS

Current Status

In this project, the current status of the work involves implementation of the micro-scheduling algorithm at Pathe. Additionally, a USA theater chain has shown keen interest in the forecasting and scheduling applications of SilverScreener. A pilot implementation of our macro MMSS is currently underway at this chain.

Future of MMSS

We are optimistic about the future of MMSS in various industries. We believe that Pathé management's request for several extensions of the original model indicates that modeling is now seen as a way to help address difficult issues. We are also optimistic about the effect of the current ICT possibilities on the further adoption and use of MMSS. They will enable the global rollout of new tools and systems in a very short period of time.

There are several options to be considered for future large-scale dissemination of these MMSS's. One attractive alternative is to develop a user-friendly desktop tool for the managers in this industry. This would begin with getting users' specifications for how exactly they would like the tool to be designed for them. Although the managers in this industry do not use model-building as a routine exercise, they extensively use spreadsheet software for internal reporting purposes. If a tool could be designed that appears to be no more complicated than using Excel, then the ensuing interactivity and diagnostics will provide the user a greater sense of control and ownership.

Another possibility is to use an application service provider (ASP) business model that provides computer-based services to customers over a network as on-demand software. This could be done in the most limited sense using a standard protocol such as HTTP. The need for ASPs has evolved from the increasing costs of specialized software systems. Also, the growing complexities of software business have led to huge costs in distributing the software to end-users, providing them upgrades, and managing service support.

The current research work opens up some important research issues and implications for theory-building. Building on Wierenga, van Bruggen and Staelin (1999), our research work asserts that there is a need for more studies in real-life company environments in this area. This would raise even more interesting issues when the implementation is in the context of globally distributed work environment. One of the key issues in this context would be the documentation of improvements in an implementation setting. As pointed out by Wierenga, van Bruggen and Staelin (1999), "what are the best ways to document improvements if there are no logical controls, e.g., the firm either fully implements the proposed strategy or does not? How can the researcher best predict what would have happened if the decision aid was not used?" Another interesting research issue from a theoretical standpoint would be the development of a taxonomy of various application settings, which would provide a prescription of which setting is more amenable to MMSS implementation. It would be interesting to develop a continuum of problem settings from relatively structured to more complex problems (refer Van Bruggen and Wierenga (2001) for a representative work in this area).

As far as the learning from the current application is concerned, it is evident that the motion picture industry is an unusual application area for implementation of MMSS. The organization culture does not favor mathematical models, and the cognitive models of the decision makers are heuristics rather than analytical. In such an environment, a lot of effort is required on the part of the model developers to gain the trust of the management. As is clear from the series of implementations discussed in this paper, trust was built in an evolutionary way. Another crucial aspect of the development process is to maintain managerial involvement in the model development process and accommodating user needs. Finally, we learned that the MMSS should play only a decision support role, as it should. There are simply too many judgmental elements in most practical settings to leave 100% of the decisions to the model. Thus, the model and the intuition of the manager together should constitute a most powerful combination.

Our experience shows that it is possible to implement MMSS in newer application domains. The present work could readily be extended to other parts of the entertainment industry, such as facilities for plays and music performances, and the scheduling of sporting events. While there is less information available about the demand for entertainment products than for frequently purchased consumer goods, substantial progress can be made in applying DSS in such fields. The theoretical concepts developed in the current research efforts could be applied to other shelf-space management application domains, such as super-market retailing, e-retailing and banner advertising. Some preliminary work in this direction is available in Raut, Swami, and Moholkar (2006), and Hansen, Raut and Swami (2006).

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