

# Realizing Real Commercial Benefit from Workflow: A Report from the Trenches

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## Abstract

The AllDay Financial Services Group has the stated business goal of being able to sell any of its products, at any time of the day or night, in any place, and through any available channel to market. In this paper, we outline the business benefits this Group has obtained from the deployment of current workflow technology and short comings of the technology that are preventing the Group from completely satisfying its business goal. We then set out the research issues raised by this experience and discuss how emerging AI technologies could be exploited in satisfying them. The AI technologies discussed include information-gathering planning, general planning, and scheduling. We conclude by encouraging the formation of partnerships between workflow users, workflow vendors and AI researchers. Such partnerships will give researchers access to real problems that can be used to demonstrate the scalability of their work and provide evidence that will encourage vendors and users to exploit the technologies. The feed back will also guide researchers on where further research should be focused.

**Keywords:** Adaptive Workflow, AI Planning, AI Scheduling.

## Introduction

The AllDay Financial Services Group<sup>1</sup> has the stated business goal of being able to sell any of its products, at any time of the day or night, in any place, and through any available channel to the market. In realizing this goal, particular interest is being focused on AllDay FS Group's call center retail banking operation with the aim of moving into telemarketing. The main strategy of AllDay FS Group is to focus on a sales through service scenario, where sales of additional products to existing customers could be achieved on the back of a standard service request. In

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<sup>1</sup> We emphasize that this is based on experience gained in a real international financial services group. We are using the name "AllDay" to ensure client confidentiality

addition to improving its call center operation, AllDay FS Group is keen to develop its ability to exploit new delivery channels, including electronic banking, the Internet or in store kiosks.

In this paper, we describe the benefits achieved from the deployment of workflow technology in AllDay FS Group's call centers and outline research challenges that must be addressed before AllDay FS Group's business goal can be fully satisfied. This paper is structured as follows. Section 2 outlines the pre-workflow operation of AllDay FS Group's call centers. Section 3 identifies the benefits received from the deployment of workflow technology in these centers. Section 4 describes the outstanding requirements that pose important research challenges for the workflow community. Section 5 outlines how AI technologies could be utilized to address a number of the challenges. Section 6 summarizes this paper and argues that the proposed research agenda will enable AI technologies to be fielded whilst simultaneously providing feedback to guide future research.

## AllDay Financial Services Group's Call Center Operation

The current teleservicing operation deals with the majority of the service requests received, most of which are account balance enquiries, funds transfers, and bill payments. Issues that cannot be handled by the front line call center staff are transferred to a back office either by e-mail or a paper based system where they are picked up and resolved.

Currently, a limited "sales through service" effort is carried out by call center staff identifying a sales lead through a service request. The lead is either followed up immediately while the customer is on the telephone, or through passing the lead to a telemarketing team, who follow it up with an outbound call to the customer later. Outbound calls are also made based on a number of pre-defined triggers such as the end of the life of a product (e.g. a loan) or the life stage of the customer (e.g. student about to graduate). These calls aim at customer retention

by selling on another or the next most suitable product. The sales process involves taking sufficient information from the customer to ensure eligibility for a product, running background credit checks, and pre-populating an application form that is sent out for signing. At this point, a case is created for that prospective customer and a diary entry is made to chase up the application form if it has not been returned within a set time-scale. On return of an application, the form and supporting documentation must be scanned, indexed, linked to the case, and put in the work stream for application processing to open the new account.

Call center and back office staff tend to specialize in a particular product type rather than support the entire product portfolio of The AllDay Financial Services Group. Additionally, all call center environments have a high turnover of staff. Employees tend to include students supplementing their incomes, mothers working shifts during school hours, and aspiring sales staff aiming to gain experience. The high turnover results in a general lack of understanding of the business and only routine calls can be handled. The result is a large number of call referrals to the back office. The problems are compounded, as there is no common process for the sale of products within AllDay FS Group, the process differs with each type of product. Product information (features and rates) is provided online in summary form for some products but on the whole it is paper based.

The "account centric" structure is reflected in AllDay FS Group's information systems. Each product is administered on an independent system, storing its own customer data separately. A number of hardware and operating system platforms are also used. With this information system infrastructure, it is difficult to get a single view of the product holding of a customer, making sales through service difficult.

In order to improve the operation of its call centers, AllDay FS Group is introducing a workflow management system. In the following section we outline the benefits being delivered by this system and, importantly, identify the business that the deployment is not addressing.

### **Benefits Realized through the Deployment of a Workflow System**

AllDay FS Group's deployment of workflow within its call centers is expected to achieve the following benefits:

- Support for work delivery across geographically disparate sites both in and outside AllDay FS Group through the routing of packages of images and data to a specified destination,
- Support for flexible work delivery, incorporating load balancing of the work across different departments in line with the resource levels available,
- An automated diary mechanism to ensure that work items for call center and back office staff are generated at the appropriate time,
- Management of quality assurance aspects through the automated routing of sample cases to supervisors for

examination,

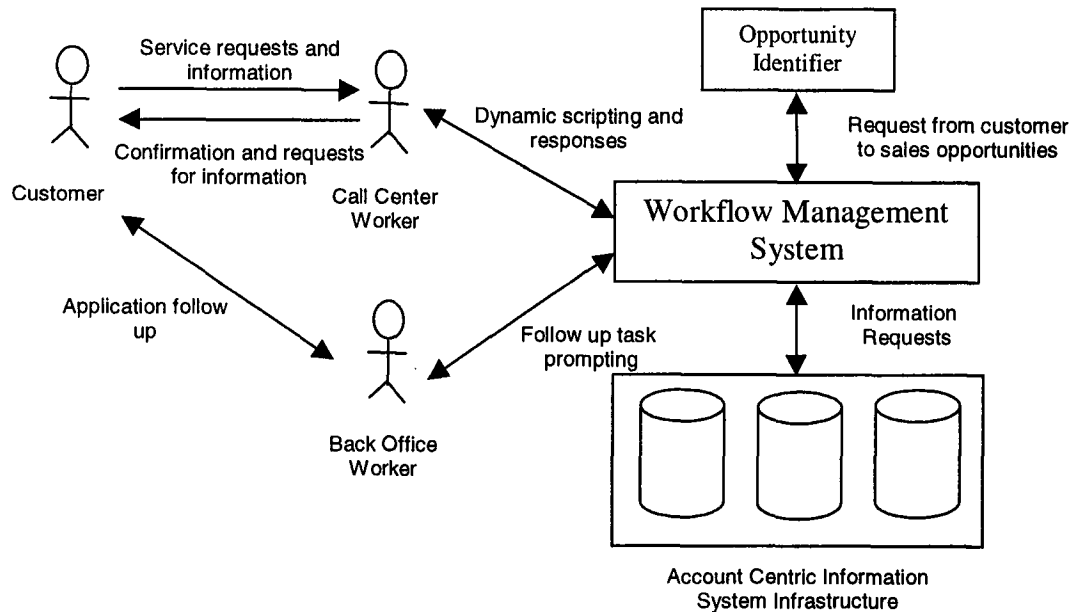
- Audit facilities enable call center staff to answer progress enquiries from prospective customers,
- Increase in the effectiveness of the back office operation as a result of the increased support for the assignment of work items to appropriately skilled agents. The skill profile of the agents would be contained in a skill matrix, which would be maintained by a nominated supervisor.

This level of support can be achieved with many of the current commercial packages. The main business benefits have come from the work delivery support. The system is expected to reduce the cost of application processing and improve customer service through the ability to view the status of requests in response to customer queries. However, to date the deployment has only improved the efficiency of the current processing system and provided the infrastructure for enabling previously independent information systems to communicate. This has resulted in two major issues. First, it has not increased the ranged number of sales applications that can be identified and effected by the front line telesales staff without the need to refer to back office staff. Second, it has not been possible to cost justify the benefits of re-engineering AllDay FS Group's processes to provide a common method for achieving each task. The following section discusses these issues in detail to motivate our research agenda.

### **Emergent Challenges for Workflow Technology**

To support front line call center staff in identifying and exploring sales opportunities across the range of AllDay FS Group's product profile, a workflow management system must be able to dynamically configure the sale process, aligning tasks and activities into a process according to the product in question. This must be supported with the dynamic production of scripts to direct the call center staff through the conversation with a customer. The workflow system must also counter the "account centric" nature of AllDay FS Group's information systems by interrogating relevant systems for information pertinent to identifying and making a sale. Simultaneously, AllDay FS Group's business processes must be reengineered to provide a common process for the sale of products. It is anticipated that this will reduce process maintenance costs and the time taken to get a new product to market. In the latter case, an approach is required which enables the specialization of a process for a new product rather than a complete design.

It is important to recognize that changes to the AllDay Financial Services Group's operation are subject to considerable inertial challenges, so implications to the organization of Financial Group must be considered. Most current processes are operating reasonably effectively. They have evolved and matured along with the company. Radical



**Figure 1: Envisaged architecture for improving sales through service**

changes are difficult to take, and very difficult to cost-justify. Current processes also represent boundaries of departments, and any change to the processes suggests the need for change to the organizational structure of AllDay FS Group in terms of its departments and responsibilities. Changes that affect this structure will need to be imposed from the highest level to ensure that the implementation is successful. In addition, people who still have the strong preference for handling information on paper forms will have to be converted to use of on-line information. To successfully initiate and drive through change in these areas, significant business benefits must be attainable.

In the following section we outline the workflow research issues that have been raised by the deployment of workflow in the Financial Group.

### Research Agenda

Figure 1 outlines a proposed architecture for supporting a sales through service operation that emphasizes the systems that a workflow management system must interface with. It is envisaged that such a system will operate as follows:

- In response to service requests from customer, the workflow system must support a call center worker by configuring a process to service the request. This will include accounting for the retrieval of customer centric information from an account centric information system infrastructure.
- During the servicing of the request, the workflow manager must relay relevant information to an "opportunity identifier" that will analyze the request and the customer's background to identify sales opportunities. During its operation, the "opportunity

identifier" will task the workflow system to retrieve customer centric information from the account centric information system infrastructure. This retrieval must be carried out within the time window of the service request. We assume that the implementation of the "opportunity identifier" itself is not a workflow issue. Financial service groups have systems of this type that are based on techniques ranging from rule-based expert systems through to case-based reasoning and neural network technology. The issue is rather that a workflow system must be able to support such systems.

- If a sales opportunity is identified, the "opportunity identifier" will task the workflow system to integrate the sales process for that opportunity into the process of handling the original service request.
- If the customer agrees to explore the sale, the workflow system will tailor the sales process to account for information already gathered about the customer during the handling of the original service request. The workflow system must also support the collection of additional information from the Group's information systems infrastructure.

The requirements raised by the proposed operation of the workflow system in Figure 1 raises a number of challenges for workflow research. First, workflow systems must be able to dynamically configure information-gathering processes. Second, these processes must be scheduled to be achieved in the time it takes to answer a service request. Third, the workflow system must be able to integrate a sales process into a service request then order the sales process to account for the time taken to retrieve information against the need to keep the conversation with

the customer flowing.

Each of these requirements is discussed in a section below. At each stage, we identify relevant technologies that have been developed in the Artificial Intelligence community.

### **Dynamic Generation of Information Gathering Plans**

The AllDay Financial Services Group currently has an account centric and distributed heterogeneous information systems infrastructure. For example, information on a customer's mortgage will be held on a different information system to the information about his or her personal loans. The information held by the systems may also overlap. In the above example, both the mortgage and personal loan systems will both hold the customer's personnel details (salary, address, employment type etc.). The Group's information systems are further differentiated by the access time and cost parameters. For example, access requests to the Group's mortgage information system may take longer to service than those to the personal loans system. In terms of cost, requests to an external credit agency may be charged while credit checks based on internal information are not charged. This cost decision must be balance with the quality of the information returned as internal checks give a picture of a customer's financial situation in terms of only the Group's products.

Information-gathering planning is a multi faceted problem. Knoblock (1996) defines the task as including the need to identify "... the source for the information, the specific operations that are to be performed on the data, and the order in which the operations are to be performed."

Despite the practical importance of information-gathering planning, there has been relatively little work in this area and no consideration of how it might be integrated with workflow management technology. Knoblock has carried out some of the seminal work on addressing the problem of information-gathering planning in general. His early Sage system (Knoblock 1995; 1996) provided an initial approach that has been superseded by his Planning by Rewriting (PbR) framework (Ambite & Knoblock 1998). PbR aims to provide a scalable approach based upon the generation of an initial query plan that is then iteratively worked on to improve its quality. Ambite & Knoblock (1998) show promising experimental results that indicate that the PbR approach scales sufficiently well to address real-world problems.

Occam (Kwok & Weld 1996) is an information-gathering planner designed to work with the Internet. This system builds upon the Group's work on the more general problem of planning with incomplete information (Golden et al. 1994). Occam uses a forward-chaining planning algorithm that is highly specialized to the problem of information gathering. The specialization enables a number of (completeness preserving) search optimizations. Kwok and Weld's (1996) experimental results show that their system can answer small queries quickly.

The AI planning community has realized the importance

of information-gathering planning for some years. Workflow problems such as those in the AllDay Financial Services Group provide the opportunity to field the technologies developed in this community. To enable this transfer, research partnerships need to be built between workflow vendors, workflow users, and those researching this area. Such a partnership would enable experimentation with actual to problems to demonstrate the scaling of the technology. The results obtained would encourage workflow users and vendors to exploit the technology while also feeding back to the research community where further work needs to be focused.

### **Scheduling the Information Gathering in Real Time**

During the servicing of a client enquiry it is essential that the call center worker has the right information at the right time. It should not be the case that a client has to wait while information is retrieved and never the case that they should call back later. In order for the successful delivery of information to take place the system must not only be aware of the information needed now but also the information which may be needed later, i.e. the system needs to be both reactive and proactive. For example, if a request for client details is going to take two minutes then the system should be aware of other information that it could present to the call center worker immediately to allow the interactions with the client to continue. In addition, should the request fail the system should be able to reschedule quickly to find alternatives sources of the information, e.g. if the central database is overloaded then access the client's branch records instead. Central to these needs is the ability to:

- Schedule information requests in real time,
- Be aware of the alternatives and options which are available,
- Understand the tradeoff between access time and the cost of accessing the information asset.

Despite the fact this has been identified as a major concern to business, very little research has been carried out in this area. Current scheduling technologies (Smith 1994; Sadeh 1994) are aimed at manufacturing processes which are focussed on the production of artifacts, e.g. airplanes, washing machines, cars, etc. Here the focus is the on keeping down costs, reducing inventory, maximizing work in progress. They have not really focussed on the real time behavioral aspects required for these problems. Some real time scheduling algorithms have been applied to some simple problems but these are not on the scale that would be required by the AllDay banking process.

### **Dynamic Integration of a Sales Process into a Service Request**

One of the current problems faced by call center workers is identifying new sales options which arise during

discussions with a client and integrating them with the original query. The problem could be handled by creating a very elaborate "script" which tried to identify new sales options statically. This would be a similar approach to the Universal plan idea developed in the early 80s. However, as with Universal plans this approach would be cumbersome for the call center worker to use and a nightmare to maintain (Ginsberg 1989). An alternative option would be to develop process plans that were tailorable on the fly to new requirements. For example, if the call center worker was answering a query concerning a loan and the opportunity to sell a mortgage was identified then a process plan for mortgage application should be identified and instantiated. This process plan would be integrated with the current process and a new process developed. Should the client decide at a later date to drop the idea of a mortgage then the appropriate steps in the process should be excised from the plan. Thus planning, scheduling and information acquisition become an integrated cycle rather than three separate components. This would be closely integrated with the information gathering scheduling described in the previous section, i.e. new requests for information may be added and others amended as needed by the process. For example, if the process identifies the possibility of selling a mortgage to the client then the request for personal details could be amended to also bring back bank statements for the last six months.

These areas of flexible and adaptive process languages and techniques have been identified as major areas of interest in AI. However, there has been little overlap with the needs of the workflow community. Effective workflow management requires representations that makes the process logic explicit, thus allowing processes to be readily understood and adapted (Myers & Berry 1999). Another characteristic of a good process representation is the ability to support a rich set of control metaphors, including iteration, sequencing, concurrency, monitoring, testing, and suspension/resumption. Given the unpredictability of the operating environments, the ability to represent uncertainty is critical as discussed in the workflow literature (Cichocki et al 1998; Lawrance 1997)

The Procedural Reasoning System (PRS) (Myers 1997), is a hierarchical reactive control system developed by SRI. The procedural approach involves predefined procedure libraries describing processes that can be performed to achieve some goal, or that serve as appropriate responses to designated events (for example, (Firby 1994; Georgeff & Ingrand 1989, Myers 1996; Howe & Cohen 1991)). The bodies of these procedures employ rich operations and control constructs that provide a highly expressive framework for representing activity. As such, procedural reactive control is particularly well suited for the *activity-based* paradigm for workflow, although it could readily accommodate artifact and communication-based models through the introduction of appropriate ontological constructs into the basic process description languages. Systems of the type developed by Drabble et al. (1997) and

Wilkins et al. (1995) integrate reactive control and generative planning systems. The result is a system capable of the on-the-fly generation of procedures to handle unexpected events.

SWIM (Berry & Drabble 1999) leverages many of the reactive control capabilities from CPEF (Myers 1998), augmenting them with advanced resource allocation, capacity analysis, and scheduling capabilities. CPEF is a novel continuous planning and execution framework embracing the philosophy that plans are dynamic, open-ended artifacts that must evolve in response to an ever-changing environment. In particular, plans are updated in response to new information and requirements in a timely fashion to ensure that they remain viable and relevant, and replaced by alternatives when they are not. SWIM similarly embraces this philosophy, drawing a parallel between plans and workflow processes. Advanced techniques to effectively schedule tasks onto processing entities are drawn from recent work on the Squeaky Wheel Optimizer (SWO) (Joslin & Clements 1998) and effectively integrated with the process enactment using novel representations that allow process activities to "breathe" within temporal windows. The SWIM models are encoded in the ACT representation (Myers 1993), which can be directly executed by the Procedural Reasoning System (PRS). It is hierarchical and provides a rich scheme for both the representation of normative processes and the derivation of new processes based on AI reasoning and planning.

Support for the dynamic generation of processes must respect the organizational and legal norms of the environment within which a process operates. For example, an individual may require certain financial qualifications to complete the sale of products such as life insurance. Jarvis et al (1999) show how the O-Plan framework (Currie and Tate 1991; Tate et al. 1998) can be extended to enable the dynamic synthesis of processes those respect organizational and legal norms.

## Summary

In the context of the AllDay FS Group, the deployment of workflow technology has resulted in an increase in only the efficiency of the Group's current operation. To support the Group in achieving its business goal of an increased sales thorough service operation, workflow technology must meet three challenges. First, it must be able to dynamically configure information-gathering processes. Second, these processes must be scheduled to be achieved in the time it takes to answer a service request. Third, it must be capable of integrating a sales process into a service request then ordering that sales process to account for the time taken to retrieve information against the need to keep the conversation with the customer flowing. We argue that the following AI technologies a relevant to achieving this functionality: Planning and particularly Information-Gathering Planning, Execution Agents, and Scheduling techniques. We conclude by encouraging partnerships

between workflow vendors and users and the AI research community. Such a partnership would enable experimentation with actual problems to demonstrate the scaling of the technology. The results obtained would encourage workflow users and vendors to exploit the technology while also feeding back to the research community where further work needs to be focused.

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